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PRESCRIPTION MANAGEMENT SYSTEM

TECHNICAL FIELD

- 1 This invention relates to professional data management
2 systems useful in the production of product specification
3 documents such as prescriptions, service or parts orders,
4 insurance contracts and the like that require detailed
5 product and history information from multiple extensive
6 information sources, especially remote heterogenous sources.
7 More particularly, the invention relates to systems that
8 assist professionals perform their everyday work in
9 specifying customized technical products. A particularly
10 preferred embodiment relates to a computer-implemented
11 prescription management system to assist physicians in
12 prescribing and reviewing drugs.

BACKGROUND

1
2 An important professional activity undertaken by most
3 physicians during the course of their day is the prescribing
4 of drugs. Many physicians prescribe a great number of drugs
5 every day. Studies show that over two thirds of all doctor-
6 patient encounters were completed with the writing of a
7 prescription. In 1993 typical prescribers were prescribing
8 in excess of two hundred thousand dollars-worth of drugs
9 annually. While most physicians exercise the utmost of
10 professional skill and caution in prescribing, there are
11 inherent difficulties and uncertainties in the process.
12 Most physicians will probably agree that they do not have
13 access to adequate, reliable drug information and relevant
14 patient information at the time and point of prescription.
15 In particular, information regarding relevant new drugs,
16 comparative efficacy, and importantly, relative costs, may
17 not be readily and conveniently available to a physician
18 creating a new prescription, as well as relevant patient
19 information such as current conditions being treated,
20 current treatments, and preferred medications for
21 conditions, pursuant to requirements of the patient's drug
22 formulary.
23
24 Nevertheless, while accessing it is impractical for the
25 typical practitioner, such information is available to any
26 physician willing to take the time and make the effort to

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17 Typically, drug formularies comprise lists of preferred
18 drugs whose costs will be borne by a drugs benefit house.
19 Drug formulary information is usually determinative of the
20 cost-effectiveness of a prescription. Unwitting failure by
21 a prescriber to follow formulary guidelines can impose
22 unnecessary or unexpected cost burdens on the patient, or
23 their benefits provider, and lead to poor patient compliance
24 and aggravating and time-consuming disputes. The cost in
25 dollars of non-compliance with drug formulary guidelines to
26 benefit-providing corporations, insurers, health maintenance

1 organizations and government providers, for example MEDICAID
2 and MEDICARE, can be enormous. The cost of poor patient
3 compliance may ultimately increase the total cost of care by
4 generating a more serious, expensive adverse health outcome
5 (emergency room visit, or hospital admission or death).
6

7 A difficulty in making integrated patient-specific
8 information readily available to prescribing professionals
9 is that the needed information components are not
10 centralized but are widely distributed geographically and
11 even when their geographic or electronic locations are
12 known, are hard to access because of proprietary and
13 liability and patient-confidentiality concerns and because
14 of system, file or protocol incompatibilities.
15

16 Even in the computer-abundant United States, in the mid-
17 90's, prescription writing is generally a manual process.
18 After consulting with a patient to determine their problems
19 and diagnosing, or attempting to diagnose their condition or
20 disease, a physician selects a drug and a dosage and an
21 amount to prescribe based upon their own personal knowledge
22 and experience, if necessary using available reference
23 materials which may or may not include promotional materials
24 from drug manufacturers. A prescription is then written up
25 under the physician's signature and bears a patient
26 identification, a drug name, dosage amount and timing,

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22 To be fully effective, a prescription management system must
23 be readily usable by a wide range of physicians, preferably
24 for all their prescribing activity must provide compelling
25 value to patient care and increase overall treatment
26 management efficiency. Providing an attractive computer-

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9 Portable computers are a possible solution to the access
10 problem now that powerful and compact notebook computers are
11 widely available. Although currently available portable
12 computers offer some advantages particularly to physicians
13 moving between one work place and another, they also suffer
14 certain drawbacks. One drawback is that external
15 communication is difficult being commonly effected by moving
16 diskettes, a valuable but limited method, or by modem
17 connection to a telephone line which inconveniently requires
18 plugging into a wall jack. Though possibly adequate for a
19 physician having multiple offices, neither the communication
20 means nor the portability of such systems is satisfactory
21 for a ward physician moving from patient bed to patient
22 bed. The weights and form factors of traditional portable
23 computers are severe impediments to their assimilation into
24 many clinical physicians' daily lives as dependable
25 assistants to their professional work.

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1 More recently, small handheld or palm computers known as
2 personal digital assistants or personal information
3 communicators have become available. An example is the
4 Apple NEWTON (trademark). As of summer 1994, these are
5 rather rudimentary devices as compared with desktop or full-
6 powered portable systems, having modest permanent and RAM
7 storage capacities and limited processing and communications
8 abilities. Attractive to busy mobile professionals for
9 their small size, such handheld computers can also embody
10 highly desirable radio wave or infrared wireless
11 communications abilities enabling them to exchange data with
12 host systems without the cost or inconvenience of hard
13 wiring.

15 Such portable hand held radio communicating computing
16 devices are attractive for computerizing mobile
17 professionals such as physicians, but their processing and
18 storage limitations represent a real problem in providing a
19 sophisticated, capable and attractive system for physicians.

21 A broad objective of this invention is to provide a
22 prescription management system that can be used by
23 physicians on such mobile computing devices.

25 Simply delivering a system on a convenient portable computer
26 will not be enough to assure its regular use by a majority

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22 An experienced professional practicing their specialty for
23 example a pediatrician treating infants knows from
24 experience exactly what to prescribe, in many instances.
25 They will have neither the time nor the patience to work
26 their way through conventional software selection and data

1 entry procedures. Accordingly, a further object of this
2 invention is to provide a prescription management system
3 which personalizes itself to the prescribing patterns of
4 experienced users.

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SUMMARY OF THE INVENTION

7 This invention solves a problem. It solves the problem of
8 providing a computerized, prescription management system
9 that an average prescribing physician can use and will want
10 to use and which makes possible significant improvements in
11 the quality of prescriptions written. In preferred
12 embodiments, the invention also solves the problem of
13 significantly reducing prescription costs to patients and to
14 their drugs benefit management company or government agency.
15 The invention solves these problems for physicians by
16 providing a prescription management system for electronic
17 prescription creation by a prescriber at a point of patient
18 care, said prescription being usable by a pharmacist to
19 dispense drugs, said prescription management system
20 comprising:

21 a) electronic posting means to select and capture in said
22 prescription:

23 i) a patient identifier;

24 ii) a prescribed drug;

25 iii) a dosage for said prescribed drug; and

26 b) a patient-condition treatment specification procedure;

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1 whereby in creating said prescription said prescriber
2 specifies a patient condition for treatment by said
3 prescribed drug.

4
5 More generally, the invention provides a computer-based
6 professional product specification system for use by other
7 professionals, in addition to physicians, which can deliver
8 substantial benefits to mobile, users who may be computer-
9 inexperienced.

10
11 By associating a patient condition or problem with each drug
12 prescribed, a treatment objective is both expressed and
13 recorded,...physician intent... and deliver for physicians
14 the problem is solved by providing a user- friendly
15 prescription management system, requiring minimal data entry
16 enabling prescriptions to be created with an overall
17 efficiency unobtainable by any known automated system and
18 which can helpfully supplement the skills of the best of
19 practitioners.

20
21 Pursuant to one preferred embodiment of the invention, the
22 drugs in the drug list are classified according to a patient
23 condition for which the drugs are effective and the onscreen
24 drug selection procedure lists multiple drugs for treating
25 each patient problem. In an alternative embodiment, the
26 user makes a drug selection by generic or brand name or some

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1 other drug identifier, and the system supplies, suggests or
2 requires, entry of an appropriate treatment condition so
3 that the patient record is completed with the condition or
4 conditions for which the selected drug is prescribed.

5
6 The invention also provides a user-adaptive prescription
7 management system for electronic prescription creation by a
8 prescriber at a point of patient care, said prescription
9 being usable by a pharmacist to dispense drugs, said
10 prescription management system comprising:

11 a) electronic posting means to select and capture in said
12 prescription:

13 i) a patient identifier;

14 ii) a prescribed drug;

15 iii) a dosage for said prescribed drug;

16 b) a patient-condition treatment specification procedure
17 whereby in creating said prescription said prescriber
18 specifies a patient condition for treatment by said
19 prescribed drug;

20 c) an onscreen drug selection procedure having a patient
21 condition list specifying multiple possible patient
22 conditions, having a drug list specifying multiple
23 possible prescribable drugs and having drug
24 specification means to select and post a desired drug
25 to said prescription; and

26 d) tracking means to track preferred data usage by a user

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4 wherein drugs in said drug list are classified according to
5 a patient condition for which said drugs have efficacy and
6 said onscreen drug selection procedure lists multiple drugs
7 for treating each said patient problem.

19 System suggestions for condition-related drug selection may
20 be further refined into categories such as relative cost,
21 generic or brand name and so on. Where many drugs are
22 available for treating a patient's active condition, one
23 particularly useful presentation is by multiple lines of
24 therapeutic preference according to drug formulary .
25 guidelines. Thus, within the patient's particular formulary
26 there may be suggested first, second and third lines of

1 therapy. Different suggestions may be made for different
2 patients according to the preferences of the patient's
3 particular drugs benefit management company.

4
5 Preferably the system includes a comprehensive database of
6 approved drugs classified by conditions for which they are
7 known to have therapeutic effect and this database need not
8 be maintained in the users station but should be accessible
9 in real time to the user. Many valuable professional
10 benefits are obtained by delivering a selective listing of
11 drugs by condition to a physician. For example in treating
12 a particular chronic condition such as gastro-intestinal
13 disease, a physician may find that common medicaments such
14 as antacids are ineffective, that a particular brand name
15 drug such as TAGAMET (trademark) has, with prolonged use,
16 undesired side effects so that the physician may at this
17 point be interested in gaining information about alternative
18 drugs with which they are less familiar. If the physician
19 does not have the information at their finger tips, this
20 could be a time consuming process in their office reviewing
21 files and other archival information systems they have.
22 Alternatively on-line electronic services may be used but
23 this can also be a time consuming process. By offering a
24 comprehensive selection of drugs known to be effective for a
25 particular condition, this problem is easily solved for the
26 physician. The preferred embodiments include back-up

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26 b) an onscreen product selection procedure having a

1 product benefit list specifying multiple possible
2 customer benefits having a product list specifying
3 multiple possible specifiable products and having
4 product specification means to select and post a
5 desired product to said specification;
6 wherein products in said product list are classified
7 according to a customer benefit which said products can
8 provide and said onscreen product selection procedure lists
9 multiple products for providing each said customer benefit.

11 BRIEF DESCRIPTION OF THE DRAWINGS

12 By way of example, some preferred embodiments of the
13 invention are described in detail below with reference to
14 the accompanying drawings in which:-

15
16 **Figure 1** shows a system entry screen of a prescription
17 management system embodiment of the invention
18 which system incorporates the screens of
19 Figures 2-11;

20 **Figure 2** is a patient selection screen;

21 **Figure 3** shows a prescription creation screen;

22 **Figure 4** is a condition list selection screen;

23 **Figure 5** is a condition selection screen;

24 **Figure 6** is a drug selection screen, condition
25 specified;

26 **Figure 7** is a nonformulary drug selection screen;

1 **Figure 8** is an alternative condition-specification and
2 drug selection screen;

3 **Figure 9** is an alternative direct drug specification
4 screen;

5 **Figure 10** is a condition selection screen, drug
6 specified;

7 **Figure 11** is a drug selection evaluation screen;

8 **Figure 12** is a single prescription history screen.

9 **Figure 13** is a patient problem history information
10 screen; and

11 **Figure 14** is a manually updatable problem list
12 maintenance screen;

13 **Figure 15** illustrates a scheduled dosage drug package;
14 and

15 **Figure 16** is a schematic diagram of one way of
16 connecting users of the prescription
17 management system of Figures 1-14 with remote
18 source databases across network to provide
19 data and processing resources needed during
20 operation of the prescription management
21 system and useful inter alia for creation of
22 a virtual patient record.

24 **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

25 **Overview**

26 The prescription management system illustrated in Figures 1-

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1 14 can be provided in software for single-user operation on
2 a stand-alone personal computer for use, for example, by a
3 sole practitioner or for multi-user operation on a local
4 area network for use, for example, by physicians and other
5 prescribers within a single facility, hospital, group
6 practice, or the like prescribing organization, and the
7 invention can bring substantial benefits to such users and
8 their patients.

9
10 However, more significant benefits can accrue to patients,
11 physicians, drug benefit providers and the public at large
12 by implementation of the described prescription management
13 system on a regional or nation-wide basis. To this end, a
14 preferred embodiment of prescription management system
15 comprises a host computer facility supporting wired or
16 wireless network delivery of user-relevant components of
17 said prescription management system to multiple remote user
18 interface devices.

19
20 The host computer facility provides data, or access to data,
21 data processing and communications resources for users to
22 draw upon via the user interface devices. The host computer
23 facility can be a server or cluster of servers with
24 associated data storage volumes, and at least one
25 intelligent client providing access to the server or
26 servers. As will be explained in more detail hereinafter,

1 especially with reference to Figure 16, the host computer
2 facility can call upon a variety of external resources and
3 functions as a marshalling and processing center for
4 organizing resources into useful and manageable pieces for
5 utilization by limited capacity user-interface devices. In
6 a preferred embodiment it is a co-ordination point on a
7 network for a number of user-device clients. Preferably the
8 network accesses or includes a number of remote database
9 sources providing useful information elements to the system.

10

11 Referring to Figures 1 to 14 of the drawings, the screens
12 shown employ user-friendly data selection and data entry
13 devices such as are familiar to many computer users in Apple
14 Corporation's Macintosh® (trademark) and Microsoft
15 Corporation's Windows operating systems, for example
16 activatable buttons, pointers, scroll bars, icons, arrow
17 key, drop-down menus, windows and other screen symbols
18 designed for actuation by a pointing device, for example, a
19 mouse or trackball. More preferably, for compact "pocket-
20 book" computer applications, the pointing device is a pen or
21 stylus.

22

23 The prescription management system shown in this embodiment
24 of the invention has been designed for implementation on
25 physically compact, portable, user-interface devices such as
26 small portable personal computers, especially hand held

1 devices known as personal digital assistants. Those skilled
2 in the art will understand that the system can readily be
3 used on or adapted to other hardware platforms, for example,
4 a physician's desktop computer and can be expressed in
5 different software interfaces from that shown, especially
6 ones that use different input devices such as keyboards,
7 touch pads or touch screens and the like.

8
9 Pursuant to certain user-adaptive aspects of this invention,
10 the screens automatically personalize themselves, with use,
11 to adopt the patterns and habits of a regular user of a
12 particular device platform for the system, offering the user
13 their most frequently used information, drugs, conditions,
14 patients or patient groups, and so on as first line choices.
15 This adaptive characteristic is a valuable benefit endearing
16 the system to experienced users who may become impatient
17 with hierarchically accessed data.

18
19 Ease of use and suitability of the system to keyless or
20 minimally keyed platforms, especially PDA's is promoted by
21 minimizing the need for actual text or data entry by the
22 user and by emphasizing instead data selection from
23 extensive, preferably comprehensive, data lists. Preferred
24 embodiments of the invention allow quick pen selection of
25 data items through columnar pick lists.

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1 The data lists, categories, groups, addresses or routes, can
2 be organized in multiple hierarchies for rapid and flexible
3 access to multiple large, remote databases, via multiple
4 access routes to retrieve multiple related data elements and
5 assemble them into a single data file, for example, a
6 patient history file compiled from the data resources of a
7 patient's historical health providers.

8
9 A desirable goal is to provide the physician-user with
10 intelligent data lists that are, where possible, exhaustive
11 and list, for example, all prescribable drugs, all
12 conditions, all formularies or all patients and present the
13 physician with helpful first-line choices or defaults
14 selected intelligently on the basis of historical data known
15 to the system. Preferably, the selection means is fully
16 system embodied, or automatic, operating transparently to
17 the user and requiring a minimum of configurational or setup
18 operations by the user.

19
20 **Virtual Patient Record**

21 An ability to compile what may be termed a "virtual" patient
22 record from multiple remote databases of primary source
23 information is a valuable novel feature of preferred aspects
24 of this invention. Such a virtual patient record can be
25 created in a chronologically current version by online
26 interrogation of all possible primary sources of

1 electronically recorded patient history elements, by
2 retrieving those elements and assembling them into a
3 complete record. Yet the record need neither be drawn from,
4 nor committed to, permanent storage, obviating storage
5 requirements for accumulations of patient records.

6

7 The record can be assembled dynamically, on an as-needed
8 basis, consulted by an authorized system user, and then
9 dissolved, without ever having been saved, giving the record
10 a virtual character.

11

12 Record element retrieval and record assembly are conducted
13 under the auspices of the host computer facility employing a
14 novel patient data directory service providing routing
15 information to each patient's record elements. For each
16 patient, the patient data directory service lists all
17 institutions, including independent physicians, hospitals,
18 HMO's, insurance companies, and so on, known to have source
19 historical records on that patient, against a unique patient
20 identifier, such as described hereinbelow. Also listed are
21 routing or address data enabling the host facility to access
22 institutional databases to retrieve record elements. Access
23 protocols detailing, for example, what data can be accessed,
24 when it may be accessed, by whom or by what organization or
25 department it may be accessed, can be kept in a patient-
26 specified directory, or elsewhere.

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25 Bio-pattern recognition of personal user characteristics
26 including, for example, handwriting, signatures, voice

1 patterns and fingerprints is an attractive medium for
2 accepting user inputs, but in the present state of
3 development of the technology, suffers drawbacks which
4 disfavor use of bio-pattern recognition in preferred
5 embodiments of the invention. Future developments such as
6 greater processing capabilities in small user-interface
7 devices, and more accurate and efficient bio-pattern
8 recognition techniques may change this picture and favor
9 adoption of one or more forms of bio-pattern recognition.

10

11 Thus, handwriting recognition, is eschewed in preferred
12 embodiments of the invention, at the present time, because
13 writing is more tiresome to the user than pointing, pressing
14 or clicking and adds complexity and processing overhead to
15 the system. Additionally, handwriting recognition, although
16 presently available in pioneer systems, adds uncertainties,
17 may require significant user effort or adaptation and may
18 threaten data accuracy or promote user error.

19

20 Signature recognition may be desirable, if permitted by
21 regulatory agencies, for remote electronic authorization of
22 fulfillment at the pharmacy especially for mail order
23 prescription fulfillment and the pharmacy-prescriber link
24 can, if desired, add additional levels of security by
25 transmitting or exchanging supplemental electronic
26 identifiers.

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1 However, better security, in terms of ensuring that the
2 filled prescription is released to the intended patient, or
3 their agent, may be provided, by treating an electronic
4 prescription transmission to a pharmacy as an advisory
5 against which fulfillment may be initiated, while the
6 prescription is released only in exchange for a manually
7 signed hard (paper) copy. Signature recognition or
8 transmission as an individual graphic element, insofar as it
9 may be useful or required in the prescribing process, can
10 accordingly be incorporated in systems according to the
11 invention. Processing demands on the user's device can be
12 minimized by confining the device's capabilities to
13 recognition of the signatures of only those users authorized
14 to use that particular device.

15
16 Adding higher performance hardware to support the processing
17 needs of handwriting recognition may be impossible with
18 available technology if a preferred lightweight, compact
19 form factor is to be retained for the user's device. An aim
20 of the invention is to provide a qualified prescribing
21 professional with a valuable tool that imposes no
22 significant burdens of weight or volume on the user, that
23 demands little of their time and yet can respond rapidly,
24 delivering valuable drug and patient information to the user
25 from remotely located, disparate sources. In other words,
26 an aim of the invention is to provide an intelligent,

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1 knowledgeable computerized prescription pad.

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3 This aim could be compromised by adoption of handwriting
4 recognition technology at the date of this application.

5 Similar problems apply to voice recognition as a significant
6 data input medium. Either or both handwriting and voice
7 recognition may be valuable enhancements of future
8 embodiments of the inventive systems especially if future
9 technology makes these capabilities available on smaller
10 user devices. In particular, limited voice recognition may
11 be valuable as a user identifier for password access or as
12 an authorizing signature.

13

14 **Security**

15 Security may be provided by password protection operating
16 hierarchically on one or more levels, to provide varying
17 degrees of access according to the user's level of
18 authorization, as desired. Additional password or numeric
19 code control may protect sensitive system-accessed
20 information, for example, patient records, or parts thereof,
21 or physician-user data, including personal lists and
22 prescribing profiles.

23

24 Patient record access codes can, in selected instances, be
25 patient provided, or granted by intelligent security control
26 cards, having been furnished to the patient by a system

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25 A still more preferred feature is to have user passwords
26 which link each user with an individual profile or style

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1 Currently contemplated preferred embodiments further control
2 the processing and storage demands placed on the user's
3 device by intelligently delegating data-processing and
4 storage activities to a linked remote, host computer
5 facility, as referenced above, to the extent warranted by
6 the capabilities of the user device. Thus, for example, a
7 comprehensive drug database may be stored and maintained on
8 such a host computer facility with selected data, for a
9 particular drug list or an individual drug's formulation
10 characteristics, being forwarded to the user's device on an
11 as-needed basis, then being eliminated from the user device
12 when no longer required. Other activities may
13 advantageously be performed locally on the device, such as
14 dynamic assembly of records from elements retrieved across
15 the network from remote storage, and storage of the user's
16 personal or most frequently referenced data and data lists,
17 where the device's capabilities permit.

18
19 Where the user device is more powerful than present-day
20 PDA's, for example a present-day desktop computer or perhaps
21 the PDA's of the future, more processing and data storage
22 functions can be retained at the user device rather than
23 delegated to the network. Although permanent (disk,
24 diskette or flash memory) storage may have uses, security
25 concerns can be better managed on the network than on the
26 user device, so that it is preferred that minimal data be

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20 The screens are designed to be non-intimidating to computer-
21 inexperienced professionals and to present familiar
22 information and terminology to them while avoiding
23 specialist computer jargon. Individually, they are easy-to-
24 use for novices yet rapid enough for experienced users.
25 Collectively, they provide an appealing system interface
26 which can flexibly integrate into a physician's personal

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3 In addition, the screens are laid out in the manner of
4 appealing logical forms that echo familiar data formats
5 encountered by a physician in their day-to-day work. An
6 important objective is to make the screens self explanatory
7 within the professional's normal terms of reference so as to
8 avoid any need for access to help, although of course, HELP
9 buttons can be provided if desired and extensive help
10 documentation can also be provided. System utilities such
11 as indexing, setup and purging are either concealed from the
12 user or removed for execution on a remote host computer
13 facility. Data integrity and availability responsibilities
14 are also delegated to the host computer facility, or its
15 remote data suppliers. Thus data saving, archival, backup
16 and data-replication functions are host facility
17 responsibilities, not concerns of the user.

18

24

25 The prescription management system is made as user-friendly
26 to physicians as possible, for example, by using familiar

1 professional terminology and abbreviations. Thus terms such
2 as "**Patient**" or "**Pt**", "**Drug**" or "**Rx**", "**Condition**" or "**Dx**"
3 and "**Treatment**" or "**Tx**" are used rather than confusing
4 generalities such as "subject" and "item" that often appear
5 in generic software. The Prescription Management System
6 shown in this embodiment of the invention has been designed
7 for use with small portable personal computers, especially
8 hand held devices known as personal digital assistants.
9 Those skilled in the art will understand that the system can
10 readily be used on or adapted to other hardware platforms,
11 for example, a physician's desk top computer and can be
12 expressed in different software interfaces from that shown.

13
14 Referring now to Figure 1 the system entry screen
15 illustrated has a user-customizable button bar 10 which has
16 been set with a conventional **Quit** button 12 and a **Help**
17 button 14, along with a **Mail** button 16 for accessing an
18 electronic mail ("E-Mail") system, a **Prescribing** button 18
19 for accessing the prescription management system embodiment
20 of the invention, an **Encounter** button 20 for accessing a
21 patient encounter management system (not further described
22 herein). **Ans Svc** button 22 accesses an answering service
23 screen (not shown), which as a convenience function can be
24 dynamically linked via the host computer facility to log
25 incoming calls for the user. The answering service is
26 preferably intelligent and prioritizes, by flagging or

1 displaying, patient- or treatment-related calls, for example
2 those from a pharmacy, while screening out or de-prioritizes
3 less relevant calls.

4

5 **History-cognitive drug and condition listing**

6 A **Doctor's Lists** button 24 accesses a more or less complex
7 display of patient condition and therapeutic drug lists.

8 Preferably, the drug and condition lists are linked together
9 to associate a drug with one or more conditions for which it
10 might be prescribed and, in most cases to provide the
11 physician user with a conveniently displayed, concise
12 selection of drugs for treating any particular condition.

13 In a preferred feature of this invention, the system has a
14 user-adaptive character and adapts itself to the user's
15 habits and prescribing patterns so as to service the user
16 more efficiently. To this end, the drug lists or the
17 condition lists, or both, are system-modified with use to
18 reflect the prescribing frequency of particular drugs or the
19 frequency of occurrence of particular conditions. Thus,
20 more frequently prescribed drugs or more frequently
21 encountered conditions can be presented to the user
22 physician in a more prominent manner or more immediate
23 manner than ones found by the system to be historically less
24 common in the particular user prescribing environment. In
25 this way the system becomes more valuable with use as the
26 drug and condition lists develop into personalized lists

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1 featuring the user's preferences.

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3 With such cognitive features the inventive system is
4 effectively cognizant of ongoing prescribing activity. It
5 comes to know its user's environment and preferences, can
6 adapt itself to any number of specialist situations, and
7 can, if suitably equipped, subtly prompt the user, online
8 with original, relevant, but elusive information derived
9 from the user's computer-memorialized practice experience.

10 For example the system may prompt the user that the last
11 time Drug X was prescribed for Condition Y, Patient Q
12 reported adverse reaction Z. Where the host computer
13 facility documents a catalog of known adverse reactions to
14 system-listed drugs, a system enhancement can report new
15 adverse reactions to the user or centrally, to the host
16 computer facility, by tracking logged patient conditions and
17 relating them, where appropriate, to a previous
18 prescription. In similar manner the system may log drug-
19 drug interactions, which interactions can also be associated
20 with a target condition or conditions. Many other valuable
21 retrospective statistical studies and analyses are made
22 possible by deployment of the invention, as will be apparent
23 to those skilled in the art. While such studies are
24 potentially of immense public value if widely implemented,
25 careful controls will be required to avoid reporting
26 unrelated conditions as adverse drug reactions.

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23 Of scientific note is that the system is privy to and
24 operates at the confluence of three powerful emergent data
25 streams: encyclopedic data on therapeutic agents intended to
26 moderate particular conditions or patient problems; data on

15
16 Of commercial note is that the foregoing data may be
17 aggregated for multiple users, for example by the host
18 computing facility, for market research purposes. Also, an
19 individual user's prescribing patterns may be reviewed by
20 the user or by others. For example, drug benefits
21 companies, can review the user's prescribing patterns for
22 formulary compliance and respond by encouraging better
23 compliance, where appropriate. Release of such data to
24 third parties can be controlled to safeguard the privacy of
25 the prescriber, or other health care provider, by
26 prescriber-determined data access protocols specifying who,

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23 Preferred embodiments of the invention achieve this
24 desirable result by providing an intelligent drug-selection
25 procedure which is supported by transparent connectivity to
26 multiple remote proprietary information systems at the point

1 of care, enabling a physician to draw upon the following
2 categories of data:

- i) physician-user prescribing-frequency data;
- ii) patient drug formulary information as to a drug's status with a patient's drug benefits provider;
- iii) drug dosage characteristics, for example, form, size, route of administration, amount, frequency and the like;
- iv) drug-specific treatment information as to condition-related efficacy, and preferably as to contraindications and adverse reactions;
- v) relevant patient history information as to current and previous prescriptions, and preferably also, pursuant to the teaching of the present invention, problem-history information; and
- vi) laboratory and other diagnostic test information related to the patient's indications, to dosing, to therapeutic choices or to specific drug selections.

21 Preferably, this data is brought to the point-of-care by
22 relying upon retrieval from remote source databases at
23 remote facilities responsible for capturing original update
24 data, and not by relying upon redundant non-source data
25 requiring constant synchronization with source data to
26 remain current.

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Known automated patient record systems either ignore such remote data and work only with data created at the maintaining facility or vertically integrated health care organization, or create and maintain duplicates of the

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24 The record is viewed and may be printed out by the user,
25 with patient authorization, but does not need to be
26 permanently stored.

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20 Transactions are archived by the host system to provide a
21 complete transaction history, so that past activity can be
22 reconstructed. Such a data-reconstruction capability to
23 provide clear hind vision of the patient's record at any
24 given time is an important medicolegal capability. That
25 historical version is preferably reconstructed from a
26 transaction log and assembly of timed and dated record

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25 capability is a highly desirable adjunct to the virtual
26 patient record described herein permitting full creation and

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1 security numbers of patients who have authorized the user
2 physician to treat them, or to access the system on their
3 behalf, are listed under respective column header buttons,
4 namely, **Name** button 26, **Age** button 28, **Gender** button 30 and
5 **Social Security #** button 32.

6

7 Lists can be scanned, or text entries made in a blank search
8 box 34 at the top of the screen, using string or full name
9 searches to locate the desired patient or to review the
10 patient list. Column headers 26-32 can be clicked or
11 touched to sort the patient list on any of those fields and
12 activate search box 34. Search box 34 is linked to the sort
13 fields so that, for example, if the listing is sorted by
14 social security number then alphabetical entry attempts are
15 rejected from search box 34 and numeric entries are used as
16 social security number locators. The characters can be
17 keyed or system provided from pop-up screens, or voice or
18 handwriting recognition may be employed.

19

20 **New Pt** button 36 activates a new patient entry bar, while
21 the **Ok** button 39 accepts a highlighted patient selection and
22 advances to the prescription management screen of Figure 3.
23 **Cancel** button 38 returns to the system entry screen of
24 Figure 1.

25

26 If desired, preliminary selection of groups of patients can

1 be made by providing various patient lists, for example
2 "Today's Patients", "In-Patients", "Out-Patients", "Private
3 Patients" and the like. Such patient lists are preferably
4 system-maintained, on an ongoing basis, using the latest
5 data available to the system and preferably enable the user
6 to select a convenient group of patients that has a high
7 probability of including the next patient or patients to be
8 encountered, thereby speeding access and retrieval of a
9 desired patient record. Where the user typically encounters
10 patients in groups, for example one group in an out-patient
11 clinic and another group in an in-patient clinic, such
12 grouping of patient records into lists also facilitates
13 organization by a host computer facility of display data
14 into small batches that can more rapidly be communicated via
15 limited capacity copper wires and modems and are of a size
16 that can conveniently be held in RAM on a small, portable
17 user device.

18

19 **Patient Data Security**

20 Critical to public confidence in the prescription management
21 system of the invention are issues of security, since the
22 system requires access to personal records. Many people
23 will fear unauthorized access to or use of their personal
24 information. Preferably, the invention provides careful
25 controls to alleviate such fears and to prevent unauthorized
26 access to a patient's data or to their physician's

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26 Patient-directed control of the flow of their own data, a

1 novel concept in medical or health care information systems,
2 can be achieved by centrally inputting at the, or a, host
3 computer facility patient-generated record-access
4 specifications to determine which users, or user
5 organizations or departments (for example clinics), can
6 access what data during what period and what uses can be
7 made of the data. Clearly, such specifications must not
8 deleteriously restrict physicians in the execution of their
9 professional missions. Such record-access specifications or
10 profiles could be maintained at a remote database rather
11 than the host computer facility. Thus, access to their
12 records is controlled by patients and individuals and
13 organizations can be given patient-defined, selective access
14 or access based on a need to know, or a patient may block
15 access to all data flow, if they wish. In emergencies,
16 physicians may be able to override a patient security block,
17 but such events are recorded so that any abuse can be
18 monitored and action can be taken to discourage abusers.

19

20 **MD-Related Data Security**

21 Many similar data security considerations apply to
22 prescriber-related data. Used comprehensively, as it is
23 intended to be, the system is privy to full particulars of a
24 physician user's professional prescribing behavior, day in,
25 day out, potentially throughout their career. System
26 resources may be used to compile any desired historical

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1 record of a user's prescribing activities. Patient-
2 confidentiality aspects of this data have been addressed
3 above and can be satisfactorily managed by controlling
4 access to patient-related data in accordance with a
5 patient's previously, or currently expressed wishes, as
6 described herein. In addressing physician-oriented
7 prescribing issues, the historical record may be rendered
8 patient-anonymous by stripping the data of recognizable
9 patient identifiers, or aggregating the data. The resultant
10 historical prescribing data can communicate significant
11 information about the prescriber, is personal and
12 proprietary to the prescriber.

13
14 Pursuant to this invention, the prescriber's rights in their
15 historical prescribing data are protectable in a manner
16 similar to the protection affordable to patients, by
17 providing prescriber-determined access control
18 specifications detailing permissible levels of third-party
19 access to prescriber data. Such prescriber data access
20 control specifications can be stored in individual files on
21 the network and can comprise as to who or what organization,
22 or type of organization may access what data, for what
23 purpose and for what period of time such access right may be
24 effective. Clearly, multiple levels of access control may
25 be described to any desired degree of complexity. User
26 preferences may include user authorization for data access

1 by various third parties for example health maintenance
2 organizations (HMO's), hospitals, government agencies,
3 managed care organizations and so on.

4
5 A particular group to whom a prescriber may wish to yield
6 access rights comprises collective bargaining associations,
7 for example independent practitioner associations, preferred
8 provider organizations and physician hospital organizations.
9 Preferably, all accesses to a prescriber's data are system
10 stamped with a date, time and accessor ID, to create an
11 audit trail of such accesses, similar to the audit trail
12 left by accesses to patient data.

13
14 System-determined access control can be invoked, whenever a
15 prescriber data access request is received, by referencing
16 the prescriber's access control file and permitting or
17 denying access in accordance with the file's specifications.

18
19 **Prescription creation screen 39**

20 Referring to Figure 3, prescription creation screen 39 has a
21 full array of user-activatable buttons enabling a physician
22 to draw on powerful resources within the prescription
23 management system and supporting it in the host computer
24 facility and associated data-retrieval network, as will
25 shortly be described. Near the top of screen 39 is a
26 patient features bar 40 below which a prescription features

1 displayed as a helpful notation for the prescriber and do
2 not become prescription elements as a result of being
3 selected for display in this part of the screen. However,
4 selections made here are functional in that selected
5 problems 51 (conditions) will become defaults or preferred
6 choices in a subsequent condition specification procedure
7 and the system will review any drugs prescribed for
8 relevance to allergies 53.

9

10 Prescription features bar 42 comprises an **Rx History** button
11 54, an **Rx Options** button 56, an **Updating** indicator 58, an **Rx**
12 **Info** button 60 and a **Renew Rx** button 62.

13

14 Prescription history zone 43 displays those historical
15 prescription details that may be relevant to a current
16 prescription and has a **Condition** field 64, a **Drug** field 66,
17 a **Size** field 68 a **Dosing** field 70, a generic flag 72, an
18 **Expires** field 74 and a **Mine** field 76, in which the various
19 characteristics of patient **Mary Harrington's** previous
20 prescriptions are listed.

21

22 Prescribing zone 44 comprises three active buttons, **New Rx**
23 button 78, **Send Rx** button 80 and **Close** button 82, below
24 which extends a prescribing header bar 84 which contains
25 field identifiers for data entry of a full complement of
26 prescription details. Available prescription detail fields

1 draws up a "Today's Patients" list or whichever patient list
2 the user last selected from, or a default, user-selected
3 patient list, and provides the options of selecting a new
4 patient from alternative patient lists.

5
6 **Problems** button 50 brings up a patient problem history
7 information screen such as that shown in Figure 12 (to be
8 described) in which a historical record of the patient's
9 individual symptoms and diagnoses is listed and to which new
10 problem reports can be posted. To maintain data integrity,
11 and as a legal safeguard, historical information is not
12 editable but may be supplemented, for example by reporting
13 the subsequent status of a problem as (still) active or
14 inactive. Preferably, any such additions to the record are
15 stamped with the identity of the reporting physician,
16 providing valuable elements of a treatment decision-making
17 audit trail.

18
19 The patient's drug-related allergies, or drug reactions, are
20 brought up in possibly editable form (screen not shown) by
21 activating an **Allergies** button 48 and may be automatically
22 system updated, if desired by adding newly reported drug
23 reactions and allergies. Desired personal or drug records
24 relevant to possible allergies of this patient may be
25 summoned from the host computer facility, which may in turn
26 call on the remote database data-retrieval network for

2

4 **Rx History** button 54, scrolls, drops down, or otherwise
5 accesses any additional patient history lines beyond what
6 will fit in prescription history zone 43 and may introduce
7 vertical or horizontal scroll bars, or both, into zone 43,
8 enabling the user to display any desired section of a
9 patient's prescription history in zone 43 with the top line
0 of the history highlighted. Any desired prior prescription
1 line displayed in zone 43, can be highlighted by clicking or
2 pressing on it.

14 A highlighted prior prescription can be automatically
15 renewed by clicking or pushing an **Renew Rx** button 62.
16 Typically, prescription creation screen 39 opens with the
17 most recent prescription highlighted for possible renewal.
18 Activating **Renew Rx** button 62 posts a highlighted prior
19 prescription into prescribing zone 44 for automatic renewal,
20 after editing, if desired. Renewal of any prior
21 prescription can thus be effected in as few, as two user
22 steps by pressing **Renew Rx** 62 to post a highlighted
23 previous prescription to prescribing zone 44 and a single
24 further action to complete a prescription from there: If
25 desired option buttons such as **Renew** and **Send Last**
26 **Prescription** or **Renew All Active Prescriptions** can be added.

7

16

17 By deploying the inventive system regionally, nationally or
18 in some other population area, and employing the preferred
19 methods for retrieving patient data from remote sources, as
20 described herein, a complete patient record of all activity
21 within a region can be built. Preferably this is a virtual
22 patient record dynamically assembled only from original
23 source data, which, as described above, is maintained in
24 component form at multiple distributed source databases, is
25 retrieved therefrom across a data-retrieval network from
26 which the source databases can be accessed, and is compiled

1 or assembled into a single virtual or transient record that
2 appears to the user as an integral system data resource.

3
4 Outcome studies, prescription cost savings and drug alerts

5 Patient histories generated by the inventive system can show
6 not only the drugs prescribed, but also the conditions for
7 which they were prescribed, allergies, demographics,
8 insurance coverage, treating health care providers, and so
9 on. Known medical management systems do not provide
10 listings associating each prescribed drug with a patient
11 condition or problem, as reported to, or diagnosed by their
12 physician.

13
14 Careful review of a patient's record for relationships
15 between amelioration of problems and prescription of
16 particular drugs can provide important information about the
17 efficacy of a drug for a particular problem in a given
18 patient. Review of a physician's prescribing record,
19 detailing the various drugs selected to treat the different
20 conditions exhibited by the patients encountered in the
21 physician's daily practice, can reveal valuable information
22 about the physician's prescribing practices and the degree
23 to which they follow formulary guidelines.

24
25 This information is clearly of value to the individual
26 physician and can, if desired, be enhanced by including in

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12
13 Implementing the invention on a wider scale, valuable new
14 outcome studies and clinical trials are easily, or even
15 automatically, performed. One of many problems in
16 successfully implementing the herein described prescription
17 management system on a large scale is one of funding the
18 system. Medical cost structures, with their reimbursement
19 systems leave little scope for expenditure on aids to
20 overall practice improvements which may have to be squeezed
21 out of tight overhead budgets. Accordingly, significant
22 cost to the physician user, or user's medical facility will
23 be a major deterrent to system adoption. Preferably the
24 system is provided to prescribing users on a low-cost or no-
25 cost basis with funding from outside sources.

26

1 Implementation of the invention is expected dramatically to
2 reduce the overall cost of prescriptions and this saving has
3 been estimated to be from 20 to 40 percent of total
4 prescription costs. Savings will accrue initially to the
5 drug benefit management companies who reimburse the direct
6 costs of most prescriptions, but can be expected eventually
7 to be passed to corporations and consumers by way of lower
8 drug benefit rates. Such savings realized on a national
9 scale would amount to many billions of dollars and provide
10 an avenue of reimbursement for system proprietors. In the
11 early 1990's, the cost of prescription drug benefits is one
12 of the fastest rising components of all health care costs.

13
14 Outcome studies produced by the system may have substantial
15 value to various parties, and their sale can support system
16 costs, as may formulary compliance savings. For example,
17 drug efficacy data is of value to pharmaceutical companies,
18 as is early warning data from reliable specialists regarding
19 adverse reactions. Subject to confidentiality and other
20 relevant controls, such data can be automatically compiled
21 and readily supplied by system management, requiring only
22 approval, not active participation by involved physician
23 prescribers. Equally, the system may facilitate clinical
24 trials by identifying health care providers or prescribers
25 who would be likely participants in trials, based upon their
26 having frequently diagnosed relevant conditions, or

1 specified relevant drugs, as shown by their historical
2 prescribing profiles, or relevant patient histories.
3 Suitable patient pools can be identified similarly.

4
5 Organizations participating in outcome studies, for example
6 health maintenance organizations, insurance companies,
7 hospitals, physician alliances and the like, and may pool
8 their data but may not wish to reveal certain proprietary
9 data. By employing data access control methods for
10 accessing such organizational data, such as the methods
11 described in detail herein for controlling access to
12 patient's rights, the system of this invention can enable
13 organizations to control what data they release.

14
15 To implement such clinical trials, additional information
16 required for collection can be obtained by flagging selected
17 prescribers' profiles to trigger additional on-screen
18 routines so that whenever a trial-related drug or condition
19 is selected by the prescriber, they will be asked to supply
20 necessary additional information. For example, whenever a
21 prescriber participates in a trial relating to treatments
22 for gastritis, the system can request information as to
23 whether certain tests were performed, and what were the
24 results of those tests. Thus, the test drug might be
25 appropriate for, or be in trials relating to, gastritis
26 testing positive to *H. pylori*, whereas a different drug

1 would be indicated for *H.pylori*-negative gastritis.

2

3 The system can also provide, preferably from source
4 databases, complete prescription drug disclosure
5 requirements as set forth by the FDA, including full
6 cautionary information, for example as is now set forth in
7 the Physicians' Desk Reference (Medical Economics) and
8 Physician's GenRx (Denniston Publishing) knowledge of which
9 by the prescriber may be necessary to avoid malpractice
10 liability, and dissemination of which may limit a drug
11 manufacturer's liability. Efficient promulgation of drug
12 disclosure information to system users is tantamount to
13 publication, yet can be more current than any printed
14 document, and may be accepted as an alternative to hard copy
15 publication or supersede it.

16

17 In addition, the system provides a valuable means for
18 government agencies and others to communicate important
19 messages, such as drug warnings and alerts, quickly and
20 directly to physician users. Electronic mail accessed via
21 **Mail** button 16 can be used for this purpose, and may include
22 priority flags triggering screen alerts, but a much more
23 powerful route for communicating warnings relating to
24 particular drugs is to associate the alert with system
25 information on the drug so that when a user calls up the
26 drug in question, they receive the warning or alert, or

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26 new uses of old drugs to physicians, in a relevant manner,

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Continuous post-market-introduction monitoring of a drug in relation to the treatment of conditions is possible, and an end-to-end solution to the problem of managing unanticipated problems arising with new drugs can be provided: the system provides a vehicle data collecting relevant data; parameters

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Another advantage of the invention is that each physician user inherently and easily supplies critical enabling data for outcome studies as part of the prescribing process. No extra effort is required by the physician to make the data available for studies. One potential difficulty in making such studies is the existence of legal barriers to aggregating patient data into studies without specific

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16 Compilation of an extensive or national database of
17 (patient-anonymous) records providing a statistical
18 historical listing of drugs prescribed versus associated
19 conditions for which they were prescribed would be in the
20 public interest and of considerable value, so long as
21 patient-confidentiality were maintained. Widespread
22 adoption of the present invention can help achieve this
23 desirable goal. It is relevant to note that FDA regulations
24 only permit a drug to be promoted for approved, specific
25 therapeutic purposes but physicians are professionally free
26 to prescribe an approved drug for any condition for which

1 they believe the drug to be effective or useful so that,
2 failing specific point-of-care diagnostic information, no
3 assumptions can be made as to the treatment objectives of
4 any particular prescription. Accordingly, prior to the
5 present invention, statistical prescribing data have
6 generally lacked knowledge of why a physician prescribed a
7 particular drug, and such data is, in most cases, not useful
8 for outcome studies and cannot be related back to other
9 patient-specific variables present in the patient's medical
10 record.

11
12 Prescription history record

13 Referring to the prescription history zone 43 of the Figure
14 3 screen, under the **Condition** field 64 is listed a condition
15 reported as active when the drug was prescribed. **Drug** field
16 66 may be a generic name or a brand name. The **Size** field 68
17 is the dosage size. **Dosing** field 70 shows the dosing
18 frequency. The "G" flag 72 is for generic and is a simple
19 yes/no indicator. An **Expires** field 74 displays an
20 expiration date system calculated from the prescription
21 quantity (not shown), the size and the dosing rate and
22 indicates the day on which the prescription will run out.

23
24 The last column, **Mine** field 76, is a yes/no toggle flag
25 indicating whether the prescribing physician was the current
26 system-designated physician user ("Y" = my prescription) or

1 some other physician ("N"). Another prescribing physician's
2 details and other data relevant to a previous prescription
3 can be obtained by pressing **Rx Info** button 60, or double-
4 pressing or -clicking on the appropriate prescription
5 history line, to draw down a prescription information
6 screen, for example, as shown in Figure 12. Additional
7 available options, if any, can be accessed through the **Rx**
8 **Options** button 56.

9
10 **Update** button 58 can be a simple blinking indicator alerting
11 the user that their device is communicating with the host
12 computer facility and actively processing a local update.
13 To indicate additional time taken accessing remote
14 databases, the message can change to "Remote Retrieval", if
15 desired. Additionally, **Update** button 58 can activate
16 various update options, selectable from a menu, if desired.
17 For example, **Update** button 58 may offer a selection of
18 different sources from which to update the patient's
19 prescription history. While a preferred objective of the
20 invention is that the prescription management system obtain
21 a comprehensive, nationwide update of any previous
22 prescribing activity regarding this selected patient,
23 considerations of system speed, system development or
24 marketing considerations may make it desirable to offer
25 patient prescription histories drawn from all prescribing
26 activity in a more limited geographical region, for example,

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1 Pressing (or clicking on) highlighted fields beneath the
2 headers in prescribing header bar 84, in most cases,
3 activates pull-down menus, or data entry scrolls. Generic
4 field 90 is merely a toggled flag while **Expires** field 104 is
5 a system-calculated field. Although provision can be made
6 for a physician to make original entries, the preferred
7 embodiment provides a comprehensive selection of system-
8 generated drug prescribing data from which the user may make
9 selections.

10
11 If the user knows the drug they wish to prescribe, the drug
12 name may be keyed in or, preferably selected by highlighting
13 and clicking from one or more intelligently maintained lists
14 presented in drop-down menus to post it to the respective
15 highlighted field under **Drug** header 88. Alternatively, the
16 user can select a condition from a condition list and make a
17 drug selection appropriate to that condition from a drug
18 selection screen such as those shown in Figures 4 through 11
19 as will shortly be described in more detail.

20
21 **Generic** flag 90 is a simple yes/no indicator which is linked
22 to each drug selection to approve generic drug substitution
23 for brand name drugs by the pharmacist, if such substitution
24 is permitted by state regulation.

25
26 **Prescription quantification**

1 The **Form**, **Size**, **Route** and **Amounts** headers 92-98 are linked
2 to the drug selected and bring system resources to bear to
3 enable a prescriber rapidly to quantify the prescription
4 with appropriate dosages that can be filled at a pharmacy,
5 without undue difficulty. Activating any one of the fields
6 under headers 92-98 drops down a menu, which menus together
7 offer a selection of all known formulations of the drug
8 selected, as provided by the manufacturer, using
9 comprehensive drug inventory data accessed via the host
10 computer facility or its supporting data-retrieval networks.

11
12 The entry for **Form** field 92 may be selected from choices
13 such as capsule, caplet, tablet, and liquid. That for **Size**
14 field 94 might be a selection of 50 mg, 100 mg, and 200 mg
15 and the **Route** field 96 selections might be "PO" for per
16 oral, by mouth, "PR" per rectum, "IV" for intravenous, and
17 so on. The displays are related and intelligently selected
18 to display relevant options. Thus, for example, if "PO" is
19 selected as the route of administration, only PO dosage
20 forms are displayed. On the other hand, if PO oral forms
21 are selected, "PO" appears as the route of administration.

22
23 The **Amt** field 98 is the amount or quantity of drug to be
24 dispensed in the prescription, for example 30, 50 or 100
25 capsules or 50, 55, or 100 ml of liquid. **Refill** field 100
26 shows the number of times refilling is permitted and **Dosing**

field 102 has two columns, one being a numeric designation of a number of tablets, caplets or liquid dosages to be taken at any one time and the other being an alpha indication of the dosing frequency such as QD for daily.

In an optional, modified embodiment of the invention (not shown), the system can calculate or suggest effective dosages for a selected drug, or a narrow range of effective dosages, according to dosage-relevant patient characteristics, for example, height, weight, age, sex, pregnancy and the like, taking into account the physical formulations in which the drug is known to be available. While these characteristics might be entered or selected from lists during the prescription quantification procedure, greater power is obtained by including them on the patient's record and having the system reference these characteristics each time a new drug is prescribed for that patient and make dosage recommendations according to the known behavior of the selected drug as it applies to the current patient.

Referring to the embodiment illustrated in the drawings, **Expires** field 104 can be system-calculated field from the entries in **Amount** field 98 and **Dosing** field 102, to indicate the day on which the last dose will be taken.

Alternatively, the physician-user can select, or enter, an

1 expiration date in **Expires** field 104 for example to coincide
2 with a desired duration of treatment, or next visit, the
3 system can back-calculate refills or the amount dispensed.

4
5 Back-calculating prescription quantifiers is useful to
6 coordinate multiple prescriptions to expire on the same day,
7 for the patient's convenience and to reduce potential errors
8 or abuses. Another valuable application of an expiration-
9 controlled prescription is to benefit plan managers,
10 enabling the physician, where appropriate, readily to
11 coordinate prescription amounts to preferred schedules and
12 programs of drug benefit plan managers, for example a
13 ninety-day plan. Such preferred schedules can be system-
14 offered or defaulted, if desired.

15
16 Alternatively, if desired, means can be provided for the
17 physician themselves to write or key in the appropriate
18 dosage entries for a selected drug.

19
20 In this preferred embodiment of prescription management
21 system according to the invention, the **Drug** and **Condition**
22 fields 88 and 86 are linked together to express the
23 therapeutic objective of the user's prescribing decisions,
24 or the *prescribing intent* of the prescription, as will be
25 described in more detail with reference to Figures 4 through
26 11.

1 As stated above, a preferred objective of the invention is
2 to minimize need for keyed data entry, to minimize
3 information look-up, or preferably to avoid all need for
4 keying, by providing a comprehensive system interfacing with
5 the user through easily operated data entry devices such as
6 employed in pen-based computer devices. To achieve this
7 end, the prescription management screen of Figure 3, is
8 preferably supported by comprehensive, fully adequate, up-
9 to-date databases of drug information that, in a
10 particularly preferred embodiment of the invention, provide
11 a physician user with substantially all available relevant
12 prescribing information on drugs, especially on those drugs
13 they write most frequently, which may be favored with
14 preferential device storage on the user's interface device,
15 for rapid retrieval. Relevant prescribing information on
16 other drugs, written less frequently, or not at all by that
17 user is available on the network.

18
19 **Prescription fulfillment**

20 When drug specification is completed to the physician's
21 satisfaction, **Send Rx** button 80 is pressed to output the
22 newly created electronic prescription in any desired form
23 such as to print, to local or remote storage or to remote
24 file transfer as an electronic prescription. The electronic
25 prescription can be transmitted across a network for
26 fulfillment by any specified pharmacy, for example, the

1 patient's preferred pharmacy or a pharmacy preferred by the
2 patient's drug benefit company for the particular patient's
3 locality. Preferred routing options can be provided for the
4 patient or the drug benefit plan, or both, and the system
5 can default to appropriate options for the patient's benefit
6 plan. Routing may be more or less complex and may for
7 example split say a one-month prescription to provide a
8 bridge prescription giving the patient an immediate one- or
9 two-week supply from a local pharmacy, and sending the
10 balance of the prescription for fulfillment by a lower cost
11 mail order house. If desired, a **Bridge Rx** button (not
12 shown) may be added to prescription creation screen 39 to
13 perform such a prescription-splitting function.

14
15 Patient compliance and prescription drug abuse

16 Ensuring that a patient complies with the terms of a
17 prescribed treatment, neither neglecting nor overindulging
18 in a prescribed drug therapy, is a serious problem in health
19 care management. It is difficult to ensure that out-
20 patients actually ingest the prescribed amounts of
21 medication at the prescribed intervals. Many mistakes and
22 abuses occur. The problem is exacerbated when a patient is
23 prescribed a confusing multiplicity of drugs that may have
24 to be ingested in different amounts at different times of
25 the day. The present invention enables, and includes,
26 unique solutions to this problem that greatly facilitate a

5 One approach to enhancing patient compliance, according to
6 the invention, employs a novel dose-scheduling drug package
7 that is readily adaptable to accommodating and scheduling
8 single or multiple prescription dosages to help a patient
9 take the right dose of the right drug at the right time, and
10 will be described in detail hereinbelow.

Another approach is, to some extent, inherent in features of the prescription management system described herein. Where multiple physicians accessed by a patient utilize the system described herein, with common online access to, and assembly of, a patient's prescription history record whereby that record provides a current record of new prescriptions, then a common abuse can be controlled wherein a patient presents a problem or condition to more than one physician to obtain multiple prescriptions with a view to indulging in abusive ingestion or illicit resale. This problem is especially prevalent with analgesics. Where a physician, or perhaps pharmacist, if the patient's prescription history is available to the pharmacist, sees a similar current prior prescription has been issued, they can refuse to duplicate it.

1 patient's ability to comply with a simple or complex regimen
2 of dosages, without costly skilled supervision. In
3 addition, many types of intentional abuse can be monitored
4 and possibly prevented.

5 One approach to enhancing patient compliance, according to
6 the invention, employs a novel dose-scheduling drug package
7 that is readily adaptable to accommodating and scheduling
8 single or multiple prescription dosages to help a patient
9 take the right dose of the right drug at the right time, and
10 will be described in detail hereinbelow.

11
12 Another approach is, to some extent, inherent in features of
13 the prescription management system described herein. Where
14 multiple physicians accessed by a patient utilize the system
15 described herein, with common online access to, and assembly
16 of, a patient's prescription history record whereby that
17 record provides a current record of new prescriptions, then
18 a common abuse can be controlled wherein a patient presents
19 a problem or condition to more than one physician to obtain
20 multiple prescriptions with a view to indulging in abusive
21 ingestion or illicit resale. This problem is especially
22 prevalent with analgesics. Where a physician, or perhaps
23 pharmacist, if the patient's prescription history is
24 available to the pharmacist, sees a similar current prior
25 prescription has been issued, they can refuse to duplicate
26 it.

12

21

22 For example, the system may alert a prescriber that the
23 intended expiration date of a critical prescription has
24 passed without the prescription having been filled. The
25 prescriber thus becomes aware that the patient has gone off
26 the medication and can take steps to contact the patient and

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Clearly, modified drug packs 182 embodying the principles of that shown in Figure 15 could be configured for more (or fewer) doses or drugs or for different calendar periods, for example weekly or monthly packs rather than daily. Nor is the card configuration essential, for example, a multi-drug container could be in strip or roll or book form, or metal

1 foil sheets, with tear or press-out compartments. Dosing
2 errors are common with patients with multiple prescriptions,
3 especially the elderly. There can for example be difficulty
4 in knowing whether a dose has been taken or not. Drug pack
5 182 solves these problems in a simple inexpensive manner
6 that is prescription controlled to organize multiple doses
7 correctly and can be easily followed by most patients.
8 Individual sealing of doses is hygienic and child- or
9 overdose-resistant. Daily or weekly cards could be
10 connected together by hinges to make compact concertina or
11 book-like packs supplying a week or a month's prescribed
12 drug requirements.

13
14 Variations on the theme of a scheduled dosage package will
15 be apparent to those skilled in the art. If desired, the
16 package could be standardized as to the number of dosage
17 compartments, providing for example, a compartment for every
18 hour, with those compartments lying between desired dosage
19 times being obviously blank or never filled. A valuable
20 feature of such packaging, which could be embodied in a
21 single prescription package, is that by giving the
22 physician-prescriber some physical control over the
23 circumstances that exist when a patient is supplied with
24 drug therapy for remote administration, the prescriber gains
25 the freedom to adopt time-related dosage variations during
26 the course of therapy, without confusing the patient. In a

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26 most beneficial choices for the patient being treated, or

1 accord with the patient's formulary's preferences or with
2 the particular prescriber's preferences, pursuant to the
3 principles described herein. Specific tapering or starting
4 protocols can easily be implemented for outpatients
5 decreasing the requirement for costly skilled supervision.
6

7 Dosing Indicator Device

8 For more needy patients, the time- and date-scheduled drug
9 packaging described herein can be rendered electronically or
10 electro-optically readable, for example with bar-coding or
11 by using transparent compartments, to cooperate with a novel
12 dosing indicator device that a patient could take with them
13 to their home or on their travels. Such a novel dosing
14 indicator device, as contemplated herein, includes a time-
15 and-date clock and is designed to receive at least one
16 scheduled dosage package, as described herein, and to
17 inspect that package to determine what drug pills, capsules
18 or the like have been removed. In the event that a pill or
19 the like is detected in any bay stamped with a date and time
20 prior to the date and time clocked by the device, an audible
21 or visual or remote alert, or a combined alert, is
22 triggered. Inspection sensing is preferably electro-optical
23 and targets individual compartments with a light beam that
24 is reflected or diffused by an individual pill or associated
25 light-modulating tag, or by a bar code stamp or label which
26 is required to be removed with each dosage of any drug. The

1 device can include a movable scanner that advances in
2 relation to a package from one bay 184 to the next, scanning
3 relevant compartments in the bay, as time passes, or it can
4 comprise an array of photoelectric sensors registering with
5 individual compartments of the package, which are
6 electronically controlled and read in turn, as time passes.
7 Equivalent sensing systems will be apparent to those skilled
8 in the art.

9
10 A preferred embodiment of dosing indicator device
11 accommodates, within an aesthetically pleasing housing, a
12 multi-bay scheduled dosage package, a time-and-date clock, a
13 time-related sensor to detect the presence of a drug dosage
14 in the bays one or more alerting systems, associated
15 electronics which may include a microprocessor, and a power
16 supply, for example, a battery, ac connector or remote
17 drawdown source, or the like.

18
19 Such a dosing indicator device can be embodied as a motor-
20 driven single- or multi-drug dosage dispenser which, for
21 example, can house a tape, or strip-like and preferably
22 rolled, scheduled dosage package, having a time line along
23 the roll, and advances individual bays 184 containing one or
24 more dosages for a given dosage time, and presents a single
25 bay 184 (containing one or more dosages) for external
26 delivery and removal (for example by tearing) by the

5

21

22 A multipatient version of the drug dosage dispenser
23 described herein can also be provided for inpatient use in
24 medical or health care facilities, especially hospitals and
25 clinics. Such a multipatient version could comprise a
26 central dispensing station, located for example at a nurse's

1 station. The dispensing station can have multiple ports,
2 preferably identified with bed locations and bed-occupants'
3 names, whereby scheduled drug dosages for each bed-occupant
4 patient are dispensed at scheduled dosage intervals, if
5 desired with appropriate alerts or indicators. Nursing or
6 other staff can readily remove and administer the correct
7 drug dosages for multiple patients, possibly on a single
8 round, or at specific times of the day.

9
10 Drug contraindications

11 A further valuable feature of the novel prescription
12 management system described herein is an ability to review a
13 completed prescription for contraindications, or relative
14 contraindications, such as patient allergies to the
15 prescribed drug and such as possible drug-to-drug
16 interactions with other drugs the patient has previously
17 been prescribed. Contraindications may be clear-cut, for
18 example, penicillin *must not* be selected for penicillin-
19 allergic patients, whereas relative contraindications are
20 less decisive and may be overridden by the prescriber in
21 appropriate circumstances, for example an NSAID (non-
22 steroidal anti-inflammatory drug) may be a preferred choice,
23 in the prescriber's judgment for a patient with peptic ulcer
24 disease, in spite of the attendant risk of ??

25
26 The system can also screen or review for other possible

1 unintended adverse outcomes to the prescribed therapy, or
2 for special precautions regarding a prescribed drug's use.

3
4 Preferably, the system alerts the physician-user at the
5 point-of-care if they prescribe an offending agent, and
6 provides an alert and an opportunity to amend the
7 prescription before dispatching it for fulfillment.

8 Processing to screen for interactions may occur on the
9 user's point-of-care device or on the host computer facility
10 or remote computer system, or may be delegated elsewhere by
11 the host computer facility, and reported back to the
12 physician, online as an integral function of the
13 prescription process. Alternatively, interaction screening
14 may be run on pharmacy-related systems, and notification of
15 problems can be sent immediately to the user's point-of-care
16 device using e-mail or using procedures within the
17 prescription management application of the invention.

18
19 An allergies review can be conducted by checking system-
20 stored known allergies of patient **Mary Harrington** against
21 known pharmacokinetics and pharmacodynamics of the newly
22 prescribed drug, entered in prescribing zone 44, for any of
23 those allergies. Mary Harrington's allergy information is
24 preferably an adjunct to her patient record and is
25 downloaded to the user device from host computer facility
26 when Mary Harrington is selected from the patient selection

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1 screen of Figure 2. Drug allergenic proclivities are also
2 downloaded from one or another remote database employing the
3 host computer facility, under supervision of the inventive
4 prescription management system, but preferably at a later
5 point in the procedure, such as when a particular drug is
6 selected for posting to prescribing zone 44.

7
8 Alternatively, the requisite information can be downloaded
9 when the allergy review is conducted. Such allergy
10 screening can alternatively be effected when a new drug is
11 posted to **Drug** field 88. Either way, a positive system
12 finding, indicating a risk of allergic reaction to the newly
13 selected drug can activate a visual indicator or warning,
14 for example, **Allergies** button 52 may blink and, if desired,
15 an audible warning may sound alerting the physician to
16 reconsider their selection. Alternatively, or additionally,
17 an alert screen can tell the physician of an allergy if an
18 attempt is made to prescribe an offending drug. Such alerts
19 can be used to notify the physician of drug interactions,
20 treatment warnings or can alert them to non-compliance with
21 formulary recommendations, for example to the use of an
22 unnecessarily expensive drug, and may be accompanied by
23 suggestions for more appropriate alternative therapies.

24
25 Equivalent procedures can alert to possible drug
26 interactions and contraindications, referring to the

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1 patient's prescription history for possible active or
2 recently expired prescriptions that may interact with a
3 newly prescribed drug, and for other patient data relevant
4 to the drug's behavior in that patient. Alternatively, the
5 such a review for possible undesired aspects of the drug's
6 performance on the patient is made upon activating **Send Rx**
7 button 80.

8
9 **Electronic prescription transmission**

10 Activation of **Send Rx** button 80 can provide a drop-down menu
11 of choices including "Send this prescription" and "Add
12 prescriptions prior to sending in a batch".

13
14 A preferred embodiment of the invention includes a
15 capability whereby a completed prescription is transmitted
16 across one or more data networks for fulfillment and record
17 updating in a wired or more conveniently, for mobile
18 professionals, a wireless broadcast. Preferably, where new
19 information is generated in the prescription creation
20 process, relevant remote source databases (which may be
21 proprietary) are updated with appropriate components of the
22 new information and such updates are effected with proper
23 controls to ensure data integrity, confidentiality and
24 authenticity. Using the system as described herein, all
25 transactions generate an audit trail and are authorized or
26 preauthorized by the patient.

1 Because of the currently substantial cost of air time, batch
2 transmission is highly desirable. Accordingly, system
3 defaults encourage the physician to elect batch transmission
4 of multiple prescriptions for an individual patient,
5 although in keeping with the principle of not imposing
6 constraints on a physician, the system does not mandate such
7 batch transmission. Executing a "Send Prescription"
8 function outputs the prescription for fulfillment in any
9 desired form, posts the completed new prescription to the
10 prescription **History** zone 43 in the center of the screen,
11 and outputs the new prescription from the user's station to
12 update a control system or remote database, as desired.
13 Prescriptions can be electronically transmitted to a
14 pharmacy or pharmacy-management system for fulfillment, or
15 printed on paper for paper-based fulfillment by hand
16 delivery or fax.
17
18 The inventive prescription management system embodiment
19 disclosed herein is designed flexibly to facilitate a
20 physician's prescribing activities, to place helpful
21 information at their fingertips and reduce manual look-up
22 chores, while avoiding any authoritarian direction, mandate
23 or constraint upon a physician's professional activities or
24 judgement. Thus, while the system may attempt to provide
25 intelligent options and exhaustive selection lists, options
26 such as "other" are always available to permit the

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21 Novel drug selection methods pursuant to the invention will
22 now be described with reference to Figures 4 to 11. The
23 condition list selection screen shown in Figure 4 appears
24 upon activation of **Condition** field 86 in the prescription
25 management screen of Figure 3, to enable a prescriber to
26 approach selection of a treatment drug by first specifying a

1 diagnosed condition. Alternatively, a drug may be directly
2 specified by drug name by activating **Drug** field 88, as will
3 be described in connection with Figure 9, after which the
4 prescriber selects a condition to specify the purpose of the
5 therapy. Such condition or drug selection screens can be
6 opened by similar condition or drug buttons in any other
7 relevant screen or application, for instance in a patient
8 encounter screen where the drug selection routines now to be
9 described with reference to Figures 4 to 11 can be used to
10 assist a physician to select or review treatment objectives
11 in a computer-assisted patient encounter.

12

13 **Condition list selection**

14 The condition list-selection screen of Figure 4, provides a
15 preliminary selection of a suitable condition list from
16 which a physician user can work to select a drug. As shown,
17 the screen comprises a **Select Condition List** title 110 and a
18 **Condition List** display header 112 beneath which the names of
19 **Condition Lists** 114 are grouped in a left-hand column. A
20 right-hand column beneath header 112 displays the conditions
21 116 of whichever condition list 114 is highlighted, or
22 otherwise selected. In this case the user's personal
23 condition list 114 has been highlighted and may be seen to
24 comprise a short list of commonly occurring problems that,
25 for example, a general practitioner might encounter.

26

1 Multiple different **Condition Lists** 114 are available in this
2 embodiment to provide a range of choices to physicians, and
3 six are shown, by way of example. Three of these lists 114
4 classify conditions broadly by diagnosis (Dx) and comprise a
5 system-maintained **Dx-Personal** list 114, an alphabetically
6 organized **Dx-Alphabetic** list 114 of all conditions in the
7 system and a **Dx-Category** list 114. **Dx-Category** list 114
8 lists conditions by broad therapeutic category such as
9 cardiovascular, GI or dermatology. A fourth condition,
10 problem or diagnosis list, **Dx-Patient** list 114 lists
11 previously exhibited conditions or problems of the selected
12 patient, in this case, Mary Harrington. **Dx-Patient** list 114
13 is system maintained (and manually supplementable) and
14 changes according to the patient selected in the patient-
15 selection screen of Figure 2. **Dx-Personal** list 114 is also
16 system maintained (and manually supplementable) and changes
17 according to which prescriber signs on.

18
19 Preferably, the system includes frequency counters to track
20 the conditions the user encounters with time, and the counts
21 obtained are used automatically to maintain or generate a
22 **Dx-Personal** list 114 for the user, which more closely
23 portrays patterns of conditions encountered in the user's
24 practice as time goes by. Base periods for reporting usage
25 may be varied, or user selected, to list conditions
26 encountered by frequency in, for example, the last year, the

1 last five years, or perhaps, the last three months. Also, a
2 default can be included to highlight a selected patient's
3 last active condition or conditions as a first-line choice.

4
5 Preferably, any time a new diagnosis is made, the new
6 condition encountered is placed in the user's **Dx-Personal**
7 list 114 and any time a drug is chosen it is placed in a
8 personal drug list for the user. The first time either a
9 condition or a drug is selected, it is added to a user
10 profile stored on the network, for example, at the host
11 computer facility.

12
13 In addition, a physician-user can manually maintain one or
14 more custom lists, **Dx-Custom 1** list 114 and **Dx-Custom 2** list
15 114, for their own preferred short lists of conditions
16 being, for example, conditions appropriate to their
17 specialty that the individual physician frequently
18 encounters for treatment. Alternatively, libraries of
19 specialty lists may be made available from which the user
20 selects one or two lists for their personal use. Such
21 custom lists 114 may be associated with different user
22 activities, for example, **Dx-Custom 1** could be used at a
23 hospital where the user is an attending physician, while **Dx-**
24 **Custom 2** is used at a pain clinic where the user is a
25 visiting physician. The various condition lists 114
26 provide alternative pathways to drug selection that a

1 physician may use as an aid to deciding upon a course of
2 treatment. Different pathways may suit different clinical
3 circumstances or prescribers. Availability of alternative
4 routes to relevant drugs may enable a physician to find
5 improved treatments, and increase their range of choices,
6 and may lead to new solutions to difficult prescribing
7 situations.

8
9 The condition list selection screen shown in Figure 4 is a
10 gateway to other condition and drug selection screens. As
11 an alternative for quicker selection, a preferred condition
12 list (typically a **Dx-Personal** list 114) could be set as a
13 default with other condition lists 114 being reached via a
14 **Change Condition List** button (not shown).

15
16 Any or all condition lists 114 can be automatically
17 supplemented or maintained by the system as it receives data
18 in the course of processing numerous prescriptions for one
19 or more physician users. In addition to supplementation
20 with user-originating data, preferred embodiments maintain
21 user profiles on a host computer facility which continually
22 refreshes the data at the user's device so that the user can
23 use any device or share a device with other users.

24
25 **Condition selection**

26 In the **Select Condition** screen of Figure 5, the patient

17
18 Different pathways to a drug via conditions organized in
19 other ways, notably by body system, are illustrated in
20 Figure 8, described hereinbelow. Direct pathways of drug
21 selection using drug lists are illustrated with reference to
22 Figures 9 and 10, described hereinbelow.

24 In the example shown in Figure 5, the user-physician has
25 highlighted and selected a patient condition 116, namely,
26 peptic ulcer disease (PUD)/gastritis, displaying, in the

1 next right-hand column (see Figure 6), a short, system-
2 generated list of drugs known to be therapeutically
3 indicated for PUD/Gastritis and which may be suitable for
4 prescription or to have been prescribed in the past by that
5 user for treating these conditions. The presence of the
6 user's previously prescribed drugs, which may not
7 necessarily appear on third parties' lists, helps
8 personalize the list to the user.

9
10 Referring to Figure 6, now that a condition, **PUD/Gastritis**,
11 has been selected, a new screen title, **Select Drug 111**,
12 appears and selection of a drug to treat this condition
13 proceeds. To aid the selection, a condition-specific,
14 formulary drug list 118 is displayed in the next right-hand
15 column of the **Select Condition** screen of Figure 6 under
16 **Formulary Drug** header 120. Alternatively, a physician's
17 personal list of drugs may be displayed with formulary drugs
18 highlighted. If desired, relative cost information can be
19 included or alternative drugs may be ranked by preference of
20 the formulary manager.

21
22 Formulary Drugs are those listed by a drug formulary
23 specified by, or relevant to, the patient, in this case,
24 Mary Harrington. The drug formulary may be generated by a
25 prescription benefits management company and is a key
26 ingredient in a system for reducing overall prescription

3

19

20 To the contrary, the system of this invention is designed to
21 empower a physician to make informed choices at the point of
22 care. The system fosters quality, cost-effective
23 prescribing. Physicians do not have to attempt to remember
24 drug formularies and formularies may be changed with instant
25 effect on all users without having physicians relearn the
26 formulary. Where formulary information is called across a

1 data-retrieval network, each time it is required, in
2 accordance with preferred embodiments of the invention, from
3 a remote source database, updates are automatically posted
4 across the network.

5
6 Nonformulary drugs may be substantially more expensive than
7 formulary drugs, or may not be covered by the patient's drug
8 benefits plan, and may require out-of-pocket payments by the
9 patient which circumstance may cause administrative problems
10 to the physician and be a burden to the patient. Worse
11 still, the patient may not have the prescription filled.

12
13 By including pharmacy-derived prescription fulfillment
14 information, a patient prescription history can indicate
15 whether a patient actually received a medication. The
16 physician can be alerted (by e-mail) if a patient has not
17 filled a prescription for a critical medication, for example
18 LASIX (Hoechst), prescribed for hypertension, enabling a
19 follow-up with the patient to be initiated.

20
21 Where formulary drugs are professionally acceptable to the
22 physician and of equivalent therapeutic effect to non-
23 formulary drugs, failure to use them is clearly undesirable.
24 This problem is overcome by the present invention. If the
25 physician is satisfied with the formulary drugs offered by
26 the prescription management system of this embodiment,

3

5

16

17 Having made the decision to select Sucralfate, the physician
18 is informed by the system display shown in Figure 7 that
19 sucralfate is a nonformulary drug not on patient Mary
20 Harrington's prescription benefit management company's
21 schedule. With this timely notification in hand, the doctor
22 can, if appropriate, consult with a patient, explain the
23 reasons for his or her drug selection and gain the patient's
24 agreement to assuming the cost of the prescription, or
25 obtain authorization from the plan to cover the cost of this
26 prescription for this exceptional case. Physicians

1 manifesting increasing compliance flowing from use of a
2 prescription management system according to this invention
3 can expect ready approval of a non-formulary drug on a
4 justified exceptional basis.

5
6 By tying a diagnosed condition to a prescribed drug and
7 requiring a condition to be recorded as a treatment
8 objective before a prescription is fulfilled, new drug
9 formularies can be created where prescribing of a drug is
10 qualified according to the condition treated. For example,
11 an expensive drug like captopril may be a first-line
12 formulary choice for an acute condition such as congestive
13 heart failure, but not a first-line choice, or may even be
14 excluded as non-formulary, if prescribed for a chronic
15 condition such as hypertension.

16
17 In practice, after the system learns the user's preferences,
18 most condition and drug selections will be quickly made from
19 the user's preferred or custom lists or from historically
20 derived patient lists of previously encountered conditions,
21 or previously prescribed drugs. The system adapts to the
22 prescribing user to enable rapid creation of routine
23 prescriptions. A minority of situations may call for less
24 obvious therapies or therapies with which the physician has
25 little or no experience. Physicians tend to be most
26 reluctant to prescribe new drugs. Responsible physicians

1 will usually scrutinize a great deal of relevant information
2 before prescribing a drug for the first time. This effort
3 is captured by the system which enables a prescriber to have
4 quick access to their prior experience and confine their
5 drug selections to drugs they have used previously and which
6 were satisfactory. (A physician can of course edit their
7 personal list to remove drugs that proved unsatisfactory for
8 some reason or another, whether therapeutic or not, or they
9 can be removed automatically based on decreasing frequency
10 of use.)

11
12 In other circumstances a physician will need to select a
13 drug with which they have little or no experience. Here,
14 when it is most needed, the system provides major support
15 and reassurance, presenting several different pathways to
16 appropriate solutions enabling online access to the latest
17 available scientific, clinical and commercial information
18 about a new drug as well as screening for complications.
19 The ability to offer drug detailing at the point of need for
20 new drug information can be used to attract revenue from
21 pharmaceutical companies, managed care companies or others,
22 and is especially useful in decreasing the barriers to
23 switching to first-time use of a drug. The system-provided
24 prescribing information resources that are brought to the
25 point of care are also valuable in enabling a physician to
26 make quick therapeutic substitutions.

1 The drug selection screen shown in Figure 8 offers, by way
2 of example, one route to selecting a new drug not on the
3 prescriber's short lists. Here, selection is condition
4 driven and proceeds with the selection of a condition list
5 114, **Dx by Body System** or **Dx by Therapeutic Class**, and then
6 locating a drug to treat that condition; or alternatively,
7 by directly selecting a drug via drug lists 115 **Rx by**
8 **Therapeutic Class** or **Rx by Alpha**. Displayed in Figure 8,
9 reading across the columns from left to right, are a list of
10 body systems 117 from which the prescriber has selected
11 **Musculo-skeletal**. In the next right column the system
12 displays a list of conditions 116 that might be displayed by
13 the musculo-skeletal system, of which nine are listed by way
14 of illustration. From these nine the prescriber has
15 selected **Osteoarthritis**. Osteoarthritis is posted to
16 **Condition** field 86 in prescribing zone 44 of prescription
17 creation screen 39 (Figure 3).

18
19 With a condition specified, selection proceeds to the
20 choosing of a drug to treat the condition of osteoarthritis.
21 Drug selection proceeds through a preliminary selection of
22 drug category, from a list of drug categories 119 in the
23 next column to the right, enabling the prescriber to choose
24 their therapeutic approach, in this case, as between
25 employing an analgesic, a narcotic, a NSAID (non-steroidal
26 anti-inflammatory drug) or a salicylate. A **NSAID** is chosen,

1 generating an extensive list of drugs 121 in the right most
2 column in Figure 8, from which the prescriber can make their
3 final selection which will be posted to **Drug** field 88 in the
4 prescription creation screen 39 (Fig. 3).

5
6 The complexity of the prescribing process is graphically
7 illustrated in Figure 8. Even after narrowing the field
8 down to a specific class of drugs, NSAIDS, for treating a
9 particular symptom, osteoarthritis, there are still of the
10 order of fifty drugs from which the prescriber makes a final
11 selection.

14 Direct drug selection

15 Prescribers often know what drug they want to prescribe and
16 will wish to access it very quickly, and may not use the
17 system if they are unable to do so. This goal can be
18 reached with user-adaptive personal drug lists organized to
19 default to a prescriber's preferred choices, as described
20 herein.

21
22 One preferred user-adaptive approach to providing a quick-
23 prescribing pathway to a prescription is for the system to
24 process the user's personal drug list, to highlight, or
25 short-list or otherwise present those drugs on the personal
26 list that are appropriate therapy for any of the patient's

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1 active conditions, and preferably also, that are on the
2 patient's formulary.

3

4 Referring to Figure 9, an alternative direct drug-
5 specification pathway commences, reading from left to right,
6 with selection of drug list 115 **Rx by Therapeutic Class**.

7 From a list of perhaps fifty to one hundred drug categories
8 119 which appears in the next right hand column, the
9 prescriber has picked **Diuretics**, generating an even longer
10 list of diuretic drugs 121 from which the prescriber has
11 picked **Dyazide** (trademark, Smith Kline Beecham). The system
12 now calls for entry of a condition, in this case
13 "hypertension". The extent of the lists of drug categories
14 119 and diuretics 121, again illustrates the bewildering
15 array of drug selections with which a prescriber is
16 confronted. An otherwise uncertain or overly conservative
17 decision-making process can be rendered efficient, reliable
18 and manageable by a prescription management system according
19 to the invention.

20

21 The selection program illustrated in Figure 10 provides a
22 variety of pathways for direct drug selection via five drug
23 lists 115, a personal, an alphabetic, a category list and
24 two custom lists, analogous to condition lists 114. Here
25 the user has selected **Rx-Alphabetic** list 115 and the system
26 has displayed a portion of a long, scrollable list of drugs

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1 121 in the next column. This approach can quickly locate a
2 target drug when the physician knows it by name. Here
3 **Cefixime** has been selected and the system calls for, and
4 requires, the prescriber to enter a condition before
5 proceeding to quantification of the prescription. In the
6 next column the system lists conditions that the user has
7 previously treated with Cefixime, highlighting the most
8 recent condition so treated, or the system may display a
9 previous condition of this patient that was treated with
10 cefixime, not necessarily by the current user. If the
11 physician wishes to attack some other condition with
12 cefixime, such other condition may be selected from the last
13 righthand column, activated by "other".

14 The diversity of conditions treatable with cefixime
15 illustrates the potential for outcome studies based upon
16 widespread use of systems according to the invention to
17 refine definitions of the therapeutic scope of individual
18 therapeutic agents by collecting data on effective new
19 applications and on precautions, interactions and side
20 effects.

21
22 **Some advantages of condition-specified drug prescribing**

23 Being abundantly served at the point of care with relevant
24 prescribing information at the critical moment of decision,
25 the physician can eliminate many subsequent problems or
26 difficulties which may lead to unnecessary paperwork, or

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21

22 Naturally the prescription management system of the
23 invention can provide a variety of printed reports and other
24 data outputs of any facet of the described operations. In
25 some cases, these reports can be enhanced to provide
26 entirely new products for example a dosing schedule such as

1 that described with reference to Figure 15, and shipping
2 schedules or split prescriptions divided according to
3 suppliers requirements.

4
5 Current and historical reports can, subject to the access
6 controls described herein, be patient-specific, prescriber-
7 specific or organization-specific and can be aggregated
8 across various groups, pools, geographical regions,
9 conditions, drugs, or time periods or combinations of any of
10 the foregoing to provide a valuable data resource to health
11 care providers, patients, managed care organizations,
12 government agencies and others.

13
14 Further to enhance the prescribing decision process,
15 additional features can be included on screens such as
16 Figure 7, for example drug pricing information, employing
17 actual wholesale or retail pricing, or comparative pricing
18 or on another manner of drug pricing or grouping, such as a
19 comparative scale or price rating system, or relative
20 pricing based on actual prescription benefit management
21 company contracts. Such pricing information can greatly
22 influence M.D. decision-making, improving formulary
23 compliance and reducing overall drug costs, without
24 restricting a physician's choices.

25
26 A powerful optional feature of the invention is shown in

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1 exemplary fashion by the drug evaluation screen depicted in
2 Figure 11. After a physician selects a drug from one of the
3 screens of Figures 7 to 10, the system can optionally scan a
4 drug preference database of preferred drug treatments for an
5 evaluation of the merits of the selected drug in treating
6 the condition. The drug preference database may be remote
7 and may be maintained, for example, by a managed care
8 organization, HMO, or prescription benefits management
9 company. As the Figure 11 example shows (which example
10 employs different condition and drug selections from those
11 used in Figures 6 and 7) one possible result of the database
12 scan may be an on-screen report with an alert message, in
13 header 126 advising the physician that the selected drug is
14 **"Not a first line drug"** for treating the selected condition.
15 As a helpful suggestion to the physician the system can also
16 offer alternative drugs, from listings in the drug
17 preference database, as being more meritorious for the
18 treatment of the condition in question (pursuant to the
19 maintaining benefit company's standards or, preferably, to
20 objective literature reports).

21

22 To this end, the drug selection evaluation screen of Figure
23 11 comprises an explanatory box 128 elucidating header 126;
24 an alternative drug selection menu 130; and at the bottom of
25 the screen, three action buttons; for example, **Tx Guidelines**
26 132 to access treatment information about the alternative

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1 drug highlighted in menu 130; a confirm button 134 to post
2 the physician's original drug selection, in this case
3 "Cefixime" and to return to prescription creation screen 39;
4 and a cancel button 136 which returns the user to the drug-
5 selection of Figure 7.

6
7 The treatment information available via **Tx Guidelines** button
8 132 may include a literature reference supporting the
9 system's finding that Cefixime is not a preferred first line
10 agent for treatment of the selected condition, otitis media.
11 Optionally there may be a selection on a drop-down menu from
12 the **Tx Guidelines** button 132 enabling a physician, without
13 further effort to have a copy of such a study sent to them.
14 In a further optional embodiment, **Tx Guidelines** button 132
15 can provide the user with an access point to full disclosure
16 and prescribing information on the drug. Available
17 treatment guidelines information can include details of the
18 particular conditions for which a system suggested
19 alternative drug has been found effective, adverse
20 conditions, preferred dosages and administration routes,
21 literature sources and so on. This aspect of the inventive
22 system provides a simple, nonintrusive technique for
23 bringing new drug information to physicians at a critical
24 moment of need, when creating a prescription.

25
26 Although described as a self-contained system, it will be

1 appreciated that functions such as the identification and
2 listing of drugs via conditions treated, and patient
3 prescription histories will have value in other systems, for
4 example, patient encounter management systems, and may be
5 accessed directly from such systems via a prescribing
6 information button.

7
8 As well as compensating for error or lack of information on
9 the physician-user's part, the prescription review system
10 exemplified in Figure 11 has great value as an educational
11 tool. Physicians can be subtly trained to improve their
12 drug selection behavior. By using the system aggressively
13 and exploring its information resources, as they are
14 encouraged to do by the system's prompts and alerts,
15 physician prescribers effectively receive education and
16 training at the point of care. Improvements in drug therapy
17 are subtle and complex and it is often difficult, even for
18 the most conscientious of physicians, to be abreast of
19 developments in any more than one narrow field of medicine.
20 It is just as difficult for purveyors of new drugs to break
21 in to a physician's packed work schedule to educate them as
22 to the merits of a valuable new drug.

23
24 More than one alternative drug may be offered. Also in an
25 optional embodiment not shown, the physician user may choose
26 to display a screen of drug information regarding the

1 alternative drug or any other drug. After confirming a drug
2 selection the system can review the patient's history in
3 relation to the selected drug and alert the physician to any
4 relevant allergies, one-on-one drug interactions or, if
5 appropriate, multiple drug interactions.

6
7 Often, when new drug information is presented, a physician
8 is unable to consider it, yet when the information is
9 needed, or could be used, for example at the point-of-care,
10 when creating a prescription, valuable new drug information
11 may be unavailable or forgotten. This invention solves that
12 problem by presenting new drug information in a timely
13 manner at the moment when it is most needed and a physician
14 is most interested in considering it, namely at the time of
15 writing a prescription. It gives a benefit management
16 company the opportunity to influence a physician's choice at
17 the most influential moment, during the prescribing
18 decision.

19
20 **User-adaptive drug formulary compliance**

21 Conventional formulary guidelines specify one or more
22 substantial lists of preferred drug therapies. Many of
23 these drugs will be unfamiliar to most prescribers who will
24 therefore be reluctant to prescribe them. Natural
25 professional prudence makes most physicians extremely
26 cautious about specifying powerful agents for therapeutic

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5 The system of the invention can provide a novel approach to
6 drug formulary management whereby prescriber-centric
7 formularies can be established. By means of the system,
8 drug formulary guidelines effectively adapt to the user's
9 prescribing patterns or can be followed effortlessly by the
10 prescriber. This desirable prescriber-centricity can be
11 obtained by giving priority to the prescriber's personal or
12 custom lists or, better still if they are a subset of these,
13 to the patient's history lists, and system-identifying
14 patient-formulary preferences on those lists for easy final
15 picking by the prescriber. Where the prescriber is
16 selecting a drug providing effective therapy for a just-
17 specified condition, the above procedure may often clearly
18 identify a single drug meeting all requirements or may
19 result in a short list of a very small number of drugs for
20 final selection. Where no drug is listed as meeting all
21 requirements, the system may so alert the user and suggest
22 formulary drugs not on the doctor-specific lists or ask the
23 user whether they wish to review appropriate non-formulary
24 drugs from their personal or custom lists.

1 Patient's prescription history

2 Figure 12 shows a prior prescription information screen
3 which can be displayed by double clicking the prescription
4 display line or activating **RX History** button 54 in a screen
5 zone such as prescription history zone 43 of prescription
6 creation screen 39 shown in Figure 3. The embodiment of
7 screen shown in Figure 12 provides a simple passive
8 information display, comprising an information box 138, a
9 close button 140 and a scroll bar 142 for scrolling or
10 browsing a library of prescription histories. The displayed
11 prior prescription information in box 138 comprises, for the
12 selected prescription, the condition for which the drug was
13 prescribed, the drug name, date of prescription, dates of
14 any renewals and the name, phone number and any other
15 appropriate identification of the prescribing physician, in
16 this case it is the user physician, and any other useful
17 details that may not be strictly prescribing information,
18 including appended free text, voice annotations or other
19 electronic ink. Where an "N" indication appears in the **Mine**
20 column 76 on the prescription history line in Figure 3, the
21 name of another physician who authored the relevant
22 prescription will appear in Figure 12.

23

24 In addition to conveniently presenting useful historical
25 prescription-related details, powerful optional features,
26 for example, direct E-Mail communication with the physician

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1 whose name is displayed (or with some other physician) can
2 be activated from the prescription information screen of
3 Figure 12 or other suitable screen, can be included in the
4 prescription management system of the invention. Such
5 options enable physicians to send an inquiry to, and perhaps
6 retrieve relevant records directly from another physician
7 such as a previous prescriber to the patient, or a referring
8 physician. The invention facilitates the execution of such
9 information transports during the user-physician's encounter
10 with their patient. The screen of Figure 12 could
11 additionally have an **Auto Dial** button and be linked to other
12 modes of communication to facilitate a direct connection to
13 the physician of interest. Additional options include a
14 display of historical dosage information and an ability to
15 page through all prior prescriptions or all prescriptions
16 for a given patient, a given prescriber, a given condition,
17 a given therapeutic class, and so on, recapping some of the
18 functionality of the Figure 3 prescription creation screen
19 39.

20
21 A further optional feature of the invention is shown in the
22 patient problem or condition screen of Figure 13, openable,
23 for example, from **Problem** button 50, Figure 3, which tracks,
24 as indicated by the field headers 144-156 extending across
25 the screen, a history of the patient's problems and records
26 diagnostic determinations regarding individual problems.

11

19

20 Using the Figure 13 screen the system user, or the system,
21 labels a problem or condition as new in **New** field 144;
22 describes the nature of the problem in **Problem** field 146
23 from a condition list (not shown) such as condition list 114
24 shown in Figure 4; selects a "Y" or "N" flag in **Act.**field
25 148 to show the status of the condition as active or not;
26 inserts the name of the physician adding the problem to the

1 list in **Diagnosing Physician** field 150 (which the system
2 will default to the current user); inserts the date the
3 problem was added in **Date field** 152; inserts the name of the
4 physician determining the problem is resolved or no longer
5 active in **Resolving Physician** field 154; and inserts the
6 date of resolution in **Date field 156**. Thus changes to the
7 patient record are stamped with the name and date of the
8 responsible physician to provide an audit trail. A
9 physician identifier can be added if desired.

10
11 Problems that no longer manifest themselves to the patient
12 or physician can be indicated as not active in **Act** field
13 148. The problem list can be sorted by header selection and
14 preferably presents active problems at the top of the list
15 by default.

16
17 Such a system-maintained problem list provides an easy and
18 convenient reference to the patient's history of conditions
19 or problems and of the duration and currency of such
20 problems and constitutes a valuable case management tool for
21 physicians. The problem list is automatically supplemented
22 during the prescribing process with the latest prescriber's
23 latest observations and diagnoses, as indicated by selection
24 of one or more conditions for posting to a new prescription.

25
26 Where a patient complains of an old problem a quick

1 prescription creation routine comprises selecting the
2 problem from the **Dx-Patient** list 114, then selecting a drug
3 from a system-generated pick list of drugs providing
4 appropriate therapy for that condition. The pick list is
5 preferably drawn from the doctor's personal list and is
6 either compliant with the patient's formulary guidelines, or
7 indicates those guidelines, for example by inverse video,
8 highlighting or the like, and also includes a selection of
9 "other" to access drugs not on the prescriber's personal
10 list. Such a quick prescription routine enables the most
11 routine situations to be promptly handled, yet permits the
12 physician to expand their prescribing horizons and does not
13 merely require selection of the same drug as was used
14 previously. Quick treatment substitutions are made possible
15 by the system's presentation of available alternative
16 therapies enabling the prescriber easily to see what
17 alternatives are available and to explore those with which
18 they are unfamiliar.

19
20 Also the problems or conditions on this list can be
21 automatically posted to a patient problem list 114 to appear
22 as an additional "Dx" list in screens such as those shown in
23 Figures 4-10, to provide quick selection or review of a
24 patient's historical conditions. Preferably, such a **Dx-**
25 **Patient** list 114 changes automatically when another patient
26 is selected.

13

19

20 The problem list screen of Figure 13 is accessed from
21 prescription creation screen 39 (Figure 3) by pressing
22 button 50. Selecting an **OK button** 158 or **Cancel** button
23 160, the problem list returns to prescription creation
24 screen 39 (Figure 3). **Change Status** button toggles the
25 highlighted **Act** entry between "Y" and "N", and records a
26 date and physician name with any status change. **Add** button

1 164 enables a physician user to add a new condition to the
2 list, using condition selection pick lists, as previously
3 described. This routine may be used to note problems for
4 which there is no specific prescription given, e.g. obesity
5 or senile dementia.

6
7 Where the inventive prescription management system is
8 applied to statistical data collection for outcome studies,
9 it is preferable to supplement the patient record with a
10 range of relevant personnel data, to the extent that this is
11 available, for example drug abuse behavior, smoking and
12 habitual eating or drinking behavior, dietary habits,
13 marital and family status, pregnancies, ethnicity,
14 environmental factors, and so on. The system provides an
15 excellent means for tracking these factors and their changes
16 as they may pertain to an individual's health. For example,
17 data fields could be added to record any of the foregoing
18 data and the data could be updated by medical or
19 administrative personnel in preparation for a patient-
20 physician encounter.

21
22 Of particular significance to outcome studies will be death
23 certificate information, and preferably this information is
24 added to the patient problem record of Figure 13, as
25 appropriate.

26

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1 More complex embodiments of the invention can integrate
2 applications for prescription management with equivalent
3 applications for diagnostic tests, laboratory analyses, and
4 radiological studies to provide a more comprehensive patient
5 history viewable in multiple screens. Of particular value
6 in such an integrated presentation are laboratory results
7 providing drug dosing levels, renal and liver function tests
8 that provide important indications as to appropriate dosing,
9 and so on.

10
11 Figure 14 shows a manually maintainable problem record
12 maintenance screen, for physician use, which can be accessed
13 for example from the **Doctor's lists** button 24 in the system
14 entry screen of Figure 1. This screen enables a doctor or
15 physician manually to maintain their own personal customized
16 prescription, diagnosis, allergy or other useful lists, to
17 supplement the automatically maintained system lists. If
18 desired, problems the doctor's patients have experienced
19 previously can be system-added to the list, for example when
20 a patient is selected. These personalized lists or profiles
21 are posted to the network where the system can retrieve them
22 to any user interface device via a host computer facility,
23 subject to appropriate password protection or the like.
24 Relying upon such centrally stored personalized profile
25 files, the system can present a customized, personal
26 appearance, with familiar configurations, attuned to the

1 user's work habits, at any geographical location from which
2 the network can be accessed.

3
4 The problem record maintenance screen of Figure 14 comprises
5 a **Problem List** box 166, a **List Type** box 168 and a **Problems**
6 box 170 displaying a comprehensive, or preferably exhaustive
7 list of problems which can be selected and transferred to
8 the network and the physician's problem list by pressing
9 update button 172. Highlighted entries can be removed from
10 the Problem List 166 by pressing delete button 174. Save
11 button 176 and Exit button 178 perform the usual functions,
12 and preferably provide options to cancel changes, and the
13 like. Data entry box 180 permits an unlisted condition to
14 be keyed in, or otherwise entered character-by-character and
15 paging buttons 142 move between lists.

16 17 Archiving

18 Given the medical, commercial and legal significance of the
19 transactions executed and the data generated by use of the
20 system of the invention described herein, as well as the
21 value of that information to the patient, the physician and
22 many other organizations, maintenance of accurate historical
23 records, or archiving, is desirable, or essential, and
24 preferred embodiments of the invention provide archiving at
25 a host computer facility 106.

26

1 Data storage burdens attendant upon long-term archiving are
2 substantially relieved by using virtual patient records, as
3 described herein. Pursuant to the principles relating to
4 the use of virtual patient records dynamically created from
5 source data record elements, the invention prefers to
6 archive such data as will enable a full and accurate record
7 of the past to be regenerated from diverse sources, rather
8 than recording the past verbatim. Date and time stamped
9 record elements allow recreation of a virtual patient record
10 at any point in time.

11
12 Preferably, the data logged into archives comprise all data
13 relevant to a patient's diagnosis and therapies, data
14 relevant to the user's prescribing activities, including the
15 prescriber's relevant electronic communications ("e-mail")
16 with third parties (pharmacies, laboratories, other health
17 care providers, or potential providers, to the patient, and
18 so on) and access audit data as to parties accessing the
19 patient's or prescriber's personal data.

20 21 System-support infrastructure

22 Referring to Figure 16, the lefthand side of the diagram
23 shows an arrangement of services and devices that provide a
24 downstream flow of data and communications resources to
25 users of the prescription management, or other system
26 described herein. The righthand side shows sources from

1 which desired data and data elements may be drawn and
2 pathways for those data to reach the user, the flow being
3 marshalled by a centrally depicted host computer.

4
5 Shown schematically in Figure 16, are a number of user
6 interface devices 200 and a desktop computer 201
7 communicating via any of a variety of communication services
8 202, through a gateway-router 204 with a host computer
9 facility 206. The drawing depicts schematically how a group
10 or pool of users working with interface devices 200 or
11 computers 201, running the prescription management software
12 of this invention, can be serviced by host computer facility
13 206. Those skilled in the art will appreciate that the
14 schematic layout shown in Figure 16 is described in terms of
15 its logical architecture and that the actual physical
16 disposition of elements may be quite different.

17
18 In addition to coordinating system-related communications,
19 especially retrieval of source data from remote databases,
20 gateway-router 204 can manage supplementary services such
21 for example as a paging service 208 or any other relevant
22 desired function.

23
24 Interface devices 200 are depicted as small form factor,
25 handheld devices, or PDA's, communicating wirelessly over a
26 WAN, a proprietary wireless service, or a cellular digital

1 each of both users and host computer facilities are intended
2 by references herein to "network" or the "network".

3

4 Communication services 202 can be any service providing
5 effective two-way data transfer between users 200 and host
6 computer facility 206. As labeled, some possible
7 communication services 202 are wired local area networks
8 "LAN₁...LAN_n", wireless local area networks "WLAN₁...WLAN_n"
9 and proprietary radio frequency packet data networks, such
10 as ARDIS and RAM (trademarks of their respective
11 proprietors), cellular digital packet data networks
12 "CDPD₁...CDPD_n" and so on.

13

14 Not shown is a wire telephone connection between a user
15 device 200 and communications gateway-router 204. This is
16 of course a possible embodiment of the invention and it is
17 also, to be understood, local area networks LAN_n, could
18 comprise a single desktop computer or a facility-based
19 networked system of multiple desktop, or other computers.

20

21 Communications gateway-router 204 manages communications
22 through these various media services and provides consistent
23 interfaces to users at devices 200 and to host computer
24 facility 206, regardless of which communication service 202
25 is used.

26

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1 As referenced hereinabove, host computer facility 206 can
2 comprise a client-server system in which a file server or
3 database management server, or cluster of such servers,
4 manage data storage and traffic functions, providing high
5 volume data availability to multiple intelligent clients
6 linked, typically over a local area network, to the server
7 or servers.

8
9 Exchanging data, programs and processing services across
10 this system, user interface devices 200 and host computer
11 facility 206 support applications such as the prescription
12 management system of the invention, E-Mail services and any
13 other desired applications, for example patient encounter
14 management programs, diagnostic procedure management
15 programs, and the like, in an analogous manner to
16 conventional client-server supported operation of such
17 applications.

18
19 Host computer facility 206 provides intelligent network
20 services to user devices 200 and 201 and may support
21 ancillary services, especially for example, as described
22 hereinbefore, patient-directed data access control software.
23 Prescriber-directed data access control software or
24 organization-directed data access control software could
25 also run in an application separated from the prescription
26 management system, but is preferably integrated therewith as

1 a component of a user initialization routine.

2
3 Conveniently, patient interface components of the patient-
4 directed data access control software are run at separate
5 stations from the point-of-care locations used by
6 prescribers and are located, for example, in administrative
7 or reception areas of health care facilities or managed care
8 organizations. Here, data access rights may be read off a
9 patient's data access control card, and such cards may be
10 issued, under control of software supplied by, and in
11 communication with host computer facility 206.

12
13 The level of software and data resident on interfaces
14 devices 200 can be varied according to their physical
15 capabilities and user or system administrator preferences.
16 At a minimum, and for device redundancy, interface devices
17 200 need have resident neither files nor software, beyond
18 what is supplied with the device off the shelf.

19
20 So long as the user interface device has an operating system
21 and is communications-equipped, they may establish
22 communication with host computer facility 206, using a
23 separately supplied electronic address for that facility and
24 may upload necessary program components and data files,
25 including such personalized user profiles as have been
26 established by the user's prior experience with the system

1 and which have been stored at the host computer facility
2 206, are called from a remote host computer facility
3 supporting other users.

Neither such program components, nor data, need be stored on the interface device 200 but, where the device 200 has adequate storage capacity, it will be more convenient and faster-loading for a user to maintain configuration and user profile files, along with limited amounts of relevant drug, and possibly patient data, on the user's local interface device 200. Preferably, however basic system access software is required to be installed on the user device before system resources can be accessed. Such basic system access software can be activatable after reported loss or theft to disable system access capabilities and to render any stored proprietary data inaccessible to unauthorized users.

19 Host computer facility

20 Host computer facility 206 provides full software support
21 for user interface devices 200 and maintains complete
22 program files for the prescription management system along
23 with e-mail services and any other non-personal applications
24 that may be needed by users of devices 200 beyond the basic
25 operating systems and utilities, and the like, with which
26 the devices are originally equipped.

1 Host computer facility 206 maintains databases of patient
2 information for patients encountered or whose records have
3 previously been viewed by users of devices 200 in response
4 to calls sent via host computer facility 206, (and logged by
5 it for audit purposes) but, in keeping with the preferred
6 practice of the present invention, host computer facility
7 206 does not maintain patient records in permanent storage.
8 It could however be used to maintain patient record
9 components that are source components to users of devices
10 200 for which this particular host facility 206 is, at it
11 were, their "home" facility.

12
13 Important functions maintained by the host computer facility
14 206 are information locator databases and advanced directory
15 and routing services, including the following:

- 16 i) a user device and system registry enabling
- 17 communications to be routed to the target user;
- 18 ii) a patient information directory service enabling
- 19 access the system to access remote databases to
- 20 retrieve patient record components for compilation
- 21 of virtual patient records as described above;
- 22 iii) archiving of transaction logs and records, and of
- 23 audit logs;
- 24 iv) patient drug formularies and formulary guidelines
- 25 or locators to access same;
- 26 v) libraries of alerts and other system displayed

1 messages; and

2 vi) access control software and related data files for
3 patients, care providers and organizations.
4

5 Drug and condition lists and some drug information are also
6 maintained on the host computer facility 206, but these are
7 preferably either synchronized or refreshed at intervals
8 (e.g. overnight) from source databases of such drug
9 information. More detailed drug information (e.g. U.S.
10 Pharmacopeia information) can be retrieved from remote
11 databases by host computer facility 206. Host computer
12 facility 206 also maintains directory services for accessing
13 such drug related information, formularies, guidelines alert
14 messages and the like and updates this data remotely from
15 source databases maintained by the proprietors of the
16 information.
17

18 Also in addition, host computer facility 206 can off-load
19 data-processing functions from interface devices 200, or
20 conduct such functions in background to provide support for
21 the relatively limited processing capabilities of devices
22 200.
23

24 A further important function of host computer facility 206
25 is to retrieve multiple elements of a single patient record
26 from multiple heterogenous remote databases and to deliver

1 them to users for assembly into a virtual patient record by
2 an interface device 200 or 201, in response to the user's
3 call for that record.

4
5 Host facility 206 can reach out nationally, or
6 internationally, for example across the INTERNET (trademark)
7 to multiple remote databases such as remote databases 210
8 shown on the right hand side of Figure 16, to provide to
9 users of interface devices 200 data resources beyond (and
10 potentially more current than) those available from direct
11 storage in the device or at the host facility.

12
13 Communications

14 Communication between host computer facility 206 and remote
15 databases 210 will usually be via wire lines such as
16 telephone, or local or wide area network communication via
17 copper line, or optical fiber, or any other suitable
18 communication medium. Clearly, host computer facility 206
19 can access any remote third party database with which
20 appropriate arrangements have been made, or can be made on
21 line, and some possible source databases for patient records
22 components are labeled as "HMO's, Hospitals Insurance, Drug
23 Benefit Cos, Pharmacies, Labs and Independent Physicians".
24 Drug information may be additionally sourced from
25 pharmaceutical companies' research centers, reference
26 libraries, or publishers and the like.

1 One or more pools of users of devices 200 and computers 201
2 constitute a valuable professional audience and the system
3 provides a valuable means enabling such third party database
4 proprietors to become data publishers and electronically
5 publish or post their databases or on the network to reach
6 that audience.

7
8 Using recognizable common record element identifiers, for
9 example patient identification numbers or drug identifiers,
10 host computer facility 206 forages across available networks
11 for similarly identified record elements to retrieve.

12 Employing its information directory services as locators,
13 host computer facility can retrieve a variety of data
14 including patient-specific data, application-specific data
15 (users preferences and the like), organization-specific data
16 (formulary guidelines, for example) and general drug or
17 prescribing data, e.g. from MEDLINE.

18
19 To assist with compatibility problems with the legacy
20 systems operating at remote databases 210 and to avoid heavy
21 volumes of user calls, via the systems of the present
22 invention, interfering with or slowing down the daily
23 operations at the proprietary facilities supporting the
24 remote data bases 210, this embodiment of the invention
25 provides, at each of a limited number of remote databases
26 210 known to be a significant source of patient record

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24

25 Integrating network 214 and API's 216 and 218 permit easy
26 system integration, allow third parties to develop end-to-

1 Source data generated by point-of-care or other transactions
2 at user interface devices 200 or computers 201, can be
3 directly posted to remote databases 210 across network 214
4 which bears two-way traffic. As will be apparent from the
5 disclosure herein, remote databases also include data from
6 other places, for example pharmacies, laboratories and
7 testing facilities.

8
9 Communications gateway-router 204 also maintains a
10 physician-device directory providing routing or access
11 information needed to establish communication protocols with
12 each individual physician. This device directory service
13 can maintain an electronic address, a device identifier or
14 device configuration, operating system information and user
15 device communications protocols for each user device
16 supported by the gateway-router. User ID's can be listed
17 separately and in preferred embodiments are accompanied by a
18 prioritized listing of one or more device addresses where
19 the user may be accessed.

20
21 Other temporary or permanent update means are provided to
22 enable a user to access the host computer facility from more
23 than one device, preferably using an address that is device-
24 independent.

25

26 It will be understood that an individual host computer

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1 facility 206 can serve one group of users that may, for
2 example, be defined geographically and may number from, for
3 example, as low as 10 or 20 users in the early days of
4 establishment of the facility to hundreds and thousands as
5 the facility matures. To service more users or to service
6 users in other geographical areas, additional host computer
7 facilities 206 can be established as centralized or
8 regionally distributed hubs. Such additional host computer
9 facilities 206 will, in all likelihood, access many of the
10 same remote databases 210. Preferably, switching or
11 rerouting means are provided to optimize data traffic loads
12 between multiple host computer facilities 206.

13
14 It will also be understood that a national or international
15 network can be created by establishing a sufficient number
16 of host computer facilities 206 in strategic locations, each
17 serving a local client base of, for example campus or
18 regional users, with interface devices 200.

19
20 Summary

21 The foregoing description has emphasized an approach to
22 therapy prescribing which records an association between a
23 therapeutic agent (drug) and a condition or problem targeted
24 for resolution or amelioration by the prescribed therapeutic
25 agent. Significant benefits derive from organizing known
26 therapeutic agents according to conditions for which they

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1 are known to be effective, and emphasis has been placed
2 herein on a drug selection and specification which begins
3 with selection of a problem or condition to be treated,
4 because this is be an appealing and beneficial approach in
5 many circumstances. Frequently however, the physician may
6 know exactly what drug they wish to prescribe, in which case
7 they can proceed to a direct drug entry screen, and then
8 specify the condition targeted by the prescribed treatment.

9

10 While emphasis has also been placed in the principle
11 examples on the prescription of drugs, it will be
12 appreciated that the invention can be beneficially applied
13 to the specification of other therapies and technical
14 remedies for example to the specification of surgical
15 procedures, physical therapies and diagnostic testing.

16

17 Preferred embodiments of the invention include quick and
18 easy routines for directly posting a drug to a prescription,
19 without prior condition selection, such routines preferably
20 being by-passed. In order to gain the subsequent
21 historical review and outcome study benefits described
22 herein, it is preferred to provide for inclusion of a
23 treatment objective of the prescribed drug in the
24 prescription record before completion of the prescription.
25 The treatment objective can be rapidly selected from a
26 system-supplied list of a patient's existing or historical

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1 conditions, or through powerful system-aided selection of a
2 new condition. While a default patient condition or
3 problem may be suggested by the system for a particular
4 prescribed drug, it is preferred that such default be
5 actively confirmed by the prescribing user before being
6 accepted by the system.

7

8 To accommodate direct prescribing by drug name, **Drug** field
9 88 of the prescription creation screen of Figure 3, can open
10 a personalized or customized user-activatable drug list, or
11 proceed to comprehensive system drug lists to enable rapid
12 specification of familiar or unfamiliar drugs prior to
13 condition selection. Drug dosage selection then proceeds as
14 described above. Before leaving prescribing zone 44 of the
15 prescription creation screen 39 the system can require an
16 appropriate entry to be made in **Condition** field 86.

17

18 Other preferred embodiments enable the patient, the
19 prescribing physician and the relevant organization to
20 control the flow of their own data by predetermining access
21 rights to that data. Every transaction can be stamped with
22 a patient identifier, a prescriber identifier and, if
23 appropriate, an organization identifier, as well as with the
24 date and time of day.

25

26 Emphasis on preferred, historical or customized short lists

of drugs and conditions enables an attractive working environment to be provided even on relatively low power PDA's. Short list data may be maintained on the user device providing rapid responses in the user's most common prescribing situations. Less common situations entail calls to the host computer facility, in which circumstances delays of a few seconds while data is retrieved from the network are quite acceptable.

System requirements

User software components of a currently preferred embodiment of prescription management system described herein are designed to run under an operating system that preferably supports a full or modified version of MS-DOS® (trademark, Microsoft Corporation) WINDOWS™ (Microsoft Corporation) or other systems with user-friendly graphical interfaces, for example Apple Computer Co.'s MACINTOSH (trademark) or NEWTON (trademark) operating systems and General Magic's MAGIC CAP operating system. Other graphical environments can be used or are being developed and other embodiments of the invention may be suitably modified to optimize the application to take advantage of the unique characteristics of each such operating system environment.

The programming language used to write system software depends upon the environment of the various system

1 components. In their present stage of development, some
2 handheld PDA's require applications to be written with the
3 tools provided by their respective operating systems such as
4 NEWTON or MAGIC CAP (trademarks). For other devices such as
5 those supporting Microsoft's WINDOWS (trademark) operating
6 system, including some PDA's, a range of languages can be
7 used including for example, popular programming languages
8 such as Microsoft Corporation's "C" or Borland
9 International's "C++". For Apple Computer's MACINTOSH
10 (TRADEMARK)-based systems, languages such as THINK
11 (TRADEMARK) are appropriate.

12
13 The system is particularly advantageous when implemented on
14 any of a variety of portable computer stations especially
15 handheld units such as personal digital assistants and other
16 personal information communicators equipped with wireless
17 communicators. A preferred embodiment for mobile
18 professionals comprises such a handheld unit with two-way
19 radio or infrared communication facilities. Some such
20 devices are referenced in a "BUYER'S GUIDE: PERSONAL DIGITAL
21 ASSISTANTS" PC WEEK August 29, 1994, pages 89 and 94 the
22 disclosure of which is hereby incorporated herein by
23 reference thereto.

24
25 For compatibility with the currently rather limited
26 performance specifications of such desirable handheld

1 devices the prescription management system of the invention
2 is preferably designed to minimize the storage and
3 processing requirements placed on the user's terminal and to
4 off-load storage and processing to host computer facilities.
5 Thus, the system's support architecture aims to supply to
6 the user terminal only essential data required for screen
7 displays and other user functions, on an as-needed basis,
8 while the network stores applications and data files, for
9 example at the host computer facility.

10
11 **Modified Embodiments of the Invention**

12 While the invention has been described with a reference to a
13 particularly valuable embodiment of a prescription
14 management system, it will be understood by those skilled in
15 the art that alternative embodiments of the invention can
16 bring valuable benefits in their respective fields where
17 informed choice is desirable and can be facilitated by
18 interactive computer-assisted decision-making, especially in
19 situations where decision-relevant data is or can be drawn
20 from multiple heterogenous remote databases.

21
22 Some such possible applications of the invention are to the
23 specification of laboratory tests and also in the veterinary
24 field, and to non-pharmaceutical environments where benefits
25 such as valuable historical records and follow-up studies,
26 as well as quality control improvements, can be obtained

1 from coupling diagnostic conclusions with specified problem
2 solutions.

3
4 Thus, according to one such a modified embodiment of the
5 invention, laboratory test information can be presented to a
6 prescribing professional by first listing patient conditions
7 which the professional wishes to explore more fully by
8 specifying one or more specific laboratory tests, by
9 reporting the laboratory result and suggesting further
10 testing for differential diagnostics. The system then
11 provides a selection of laboratory tests known to be useful
12 in evaluating the relevant condition, that selection and
13 organization of laboratory tests being made in a manner
14 similar to that described for therapeutic drugs in the
15 preferred embodiments herein, and moves on to create, select
16 and order appropriate cost-controllable diagnostic testing,
17 in a comparable manner to that described herein for creating
18 a prescription.

19
20 For example, an analogous diagnostic application may provide
21 cost-effective routes to rule in or rule out specific
22 diagnoses. The specificity and sensitivity of individual
23 procedures can be translated into positive predictive values
24 and negative predictive values. By applying decision theory
25 and analyzing probable outcomes of procedures or
26 combinations of procedures in the light of the patient's

1 bio-characteristics and known conditions, diagnostic
2 protocols can be worked up and maintained with current
3 recommendations. Evaluation of the patient's history can
4 enable pretest probabilities to be established and used to
5 modulate the predictive value of one or more tests. Thus
6 the patient's history can drive the selection and
7 establishment of an optimal diagnostic test matrix for
8 identifying a patient's condition or conditions with good
9 specificity and confidence levels.

10

11 Test requirements relating to patient preparations, fasting
12 for example, and sample collection can be system specified.
13 By generating system-maintained identifiers (e.g. bar code
14 labels) for attachment to samples at the point-of-care, a
15 chain of evidence for rigorous sample accessioning can be
16 begun.

17

18 Thus, a range of possible conditions can be evaluated in a
19 differential diagnosis format designed to rule in or rule
20 out a target condition, or conditions, depending upon the
21 results of specified tests.

22

23 Extensions into the veterinary field will be apparent to
24 those skilled in the art in that instead of the physician
25 user referenced herein, reference to a veterinarian is
26 appropriate, and the patient will be an animal such as a pet

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1 car.

2

3 However, known systems do not permit the professional to
4 query the system by customer problems, nor do they provide a
5 summary of all facets of a solution to a problem leading to
6 a summarized cost of treatment. In addition the inventive
7 system can provide access to technical literature on
8 relevant problems, for example an explanation of the factors
9 causing brake squeal which can be printed out for customers.
10 This is a rather simple example. More complex examples will
11 be apparent to those skilled in the automotive and other
12 arts, especially as this art develops, with sophisticated
13 engine management and other microprocessor controlled
14 systems raising new problems and new technical solutions
15 being required. The inventive system can provide customer
16 problem lists useful for outcome analysis to drive the
17 development of better cars.

18

19 Of great value in the automotive and allied fields, equating
20 a parts supplier, such as a factory or warehouse distributor
21 with a plan benefit company is the ability to provide new
22 product descriptive and price information or updates from
23 multiple sources dynamically, in real time as transactions
24 are created. Noting the desire of a benefits company to
25 apply practical selection guidelines in an unobtrusive
26 manner to the prescribing process, an equivalent technique

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3

16

17 It will be clear to those skilled in the art that use of the
18 prescription management system described herein, employing
19 carefully maintained databases of accurate, reliable
20 prescribing data will produce high quality prescriptions
21 free of many of the problems now plaguing prescription drug
22 use. With confidence that a physician is prescribing
23 appropriate, cost-effective drugs selected from user-
24 personalized lists which link to comprehensive condition and
25 drug lists including the latest available drugs, and that
26 the prescribed drug has been reviewed for contraindications,

1 patients benefit, oversight of the prescribing process by
2 benefit companies and regulatory bodies can be reduced, and
3 litigation resulting from prescribing errors will be
4 reduced. Significant improvements in the quality of care,
5 substantial savings and the elimination of waste can accrue
6 to a national or regional health care system from widespread
7 deployment of the inventive prescription management system
8 described herein.

9
10 **Physical embodiment of system software**

11 The foregoing specification, read with the accompanying
12 drawings provides an extensive disclosure of, inter alia,
13 various embodiments of systems and software facilitating
14 professionals to select or specify technical products to
15 solve practical problems, and also to create, or assist the
16 professional to create, new products which will assist the
17 professional or their client in achieving desired problem-
18 solving goals.

19
20 It will be understood that the systems and software
21 referenced herein include, either explicitly, or implicitly,
22 software implemented on computers or other appropriate
23 hardware, including user devices such as the personal
24 digital assistants described herein, and such other
25 intelligent data processing devices having a processor, data
26 storage means and the ability to support an operating

1 system, with or without user interfaces (for example, file
2 servers,)), as may be useful in achieving the objectives of
3 this invention.

4

5 Software components and applications embodying the invention
6 can be distributed in electronic bit storage on magnetic,
7 optical, bubble or other media, optionally in transportable
8 form to be interactive with an electronic reading device,
9 for example on computer or optical diskettes, or may be
10 distributed over wired or wireless networks for storage by
11 the recipient on such media.

12

13 Preferred embodiments of the invention provide such media-
14 stored software in a commercial package accompanied by
15 instructions in printed book or booklet form, for deployment
16 of the software on particular embodiments of general purpose
17 computer to cause same to operate as a special purpose
18 computer, in accordance with the objectives of the
19 invention. License agreements, and registration means for
20 updating may also be included. Alternatively, the
21 instructions may also be provided as data files.

22

23 It will further be appreciated that such media-stored
24 software constitutes an electronic customizing machine which
25 can interact with a magnetically or optically cooperative
26 computer-based input device enabling the computer to be

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1 customized as a special purpose computer, according to the
2 contents of the software. To cause a computer to operate in
3 such customized, special-purpose mode, the software of the
4 invention can be installed by a user, or other, and will
5 usually interact efficiently with the device on which it is
6 resident to provide the desire special-purpose qualities,
7 only after selection of configuration parameters. When so
8 configured, the special-purpose computer device has enhanced
9 value, especially to the professional users for whom it is
10 intended.

11
12 While some illustrative embodiments of the invention have
13 been described above, it is, of course, understood that
14 various modifications will be apparent to those of ordinary
15 skill in the art. Such modifications are within the spirit
16 and scope of the invention, which is limited and defined
17 only by the appended claims.

18
19 Thus, while certain aspects of the invention have been
20 disclosed as embodied in connection with a prescription
21 management system, it will be apparent that they have
22 broader application in other systems or environments. Some
23 of these aspects are: dynamic assembly of records from
24 source record elements retrieved across a network from
25 heterogenous remote databases; requirements for those
26 elements to be time- and date-stamped for retrospective

1 recreation of records from archival logs; physician-centric
2 drug formularies; data-access control systems and software;
3 the novel directory services described herein and associated
4 online point-to-point e-mail and data retrieval systems;
5 data retrieval networks with API-enabled end-to-end
6 transparency; novel outcome studies, monitoring and alerting
7 procedures, studies and related products; novel scheduled
8 dosage drug packs and dispensing devices, and so on.

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